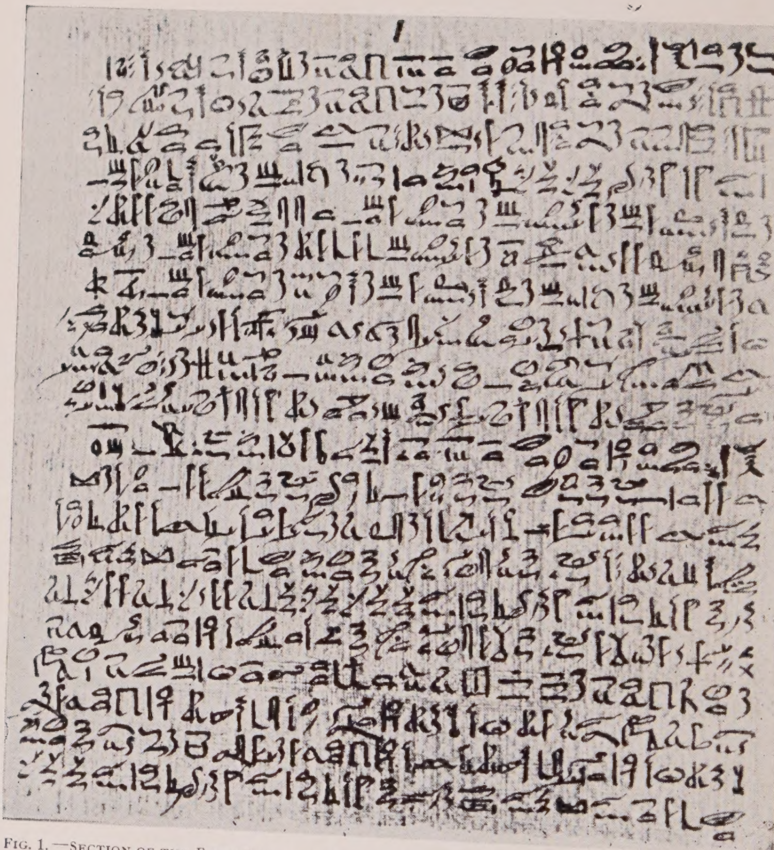

FIG. 1.—SECTION OF THE EBERS PAPYRUS. THIS MANUSCRIPT IS ONE OF THE OLDEST PHARMACEUTICAL WORKS KNOWN. IT WAS WRITTEN IN THE SIXTEENTH CENTURY B.C. SEE PAGE 3.

Frontispiece

THE CURIOUS LORE
OF
DRUGS AND MEDICINES

(*Four Thousand Years of Pharmacy*)

By

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Dean of the Philadelphia College
of Pharmacy and Science

64 FULL PAGE ILLUSTRATIONS

Garden City Publishing Co., Inc.

Garden City, N. Y.

PRINTED IN UNITED STATES OF AMERICA

THIS BOOK IS DEDICATED

TO

THE ONE WHO HAS HELPED ME IN MY WORK AND WHO HAS SHARED IN MY PLAY, WHO DOES NOT OBJECT WHEN I BRING OLD OR NEW BOOKS HOME, AND WHO ENDURES IN SILENCE THE CHAOTIC APPEARANCE OF OUR HOME DURING PERIODS WHEN MANUSCRIPT IS IN PREPARATION OR PROOF IS BEING READ; WHOSE STIMULATING COMPANIONSHIP HAS MADE ALL MY WORK POSSIBLE—

MY WIFE

INTRODUCTION

The primary function of pharmacy is to prepare medicines for those who require them. It is, therefore, a highly specialized calling, which may rise to the dignity of a true profession or sink to the level of the lowest commercialism, according to the ideals, the ability, and the training of the one who practices it.

Embracing, as it does, a variety of knowledge, scientific and commercial, its contacts with other callings cover an exceedingly wide range. Magic and superstition dominated it at the beginning, conjointly, as a rule, with medicine and religion. Alchemy influenced it for more than a thousand years. Commercialism has always been a more or less important factor and in the present era seems to have reached the highest point possible.

In consequence of these facts pharmacy, in the minds of many observers, has been so obscured that its real value and function have frequently been overlooked except by the practitioners themselves, and they, for the most part, have been so much in ignorance of the history and traditions of their own calling that they have not realized the necessity of stressing their professionalism and making the real dignity and importance of much of their work apparent.

Books upon the history of pharmacy are pitifully few, especially in the English language. The fragmentary and current literature on the subject is quite voluminous but very much scattered. The encyclopedic works of Hermann Schelenz (*Geschichte der Pharmazie*) and J. Berendes (*Das Apothekenwesen*) have never been translated into English and have no counterparts in that language. The *Chronicles of Pharmacy,* by A. C. Wootton, and the *Pictorial History of Ancient Pharmacy and Medicine,* by Hermann Peters, translated by William Netter, are almost the only books available for the American pharmacist who reads only his mother tongue, and these are both more or less disconnected as to their arrangement of subject-matter and are more suitable for reference purposes than for systematic reading or study.

The interesting and valuable communications of such frequent contributors to current pharmaceutical literature as Dr. Edward Kremers and Professor Otto Raubenheimer are too scattered to be of value to the general reader, but have been of great help in the compilation of the present work.

This attempt to cover a fascinating and instructive subject in a manner differing from that in any previous work of this kind is the out-

growth of a course of lectures on the history of science in general and of pharmacy in particular, delivered each year for more than ten years past to the students taking advanced work in Pharmacy in the Philadelphia College of Pharmacy and Science.

In addition to discussing the history of pharmacy, I have always felt the need for the student to know something of the history of general science and of some of the professions, arts, and sciences particularly related to pharmacy, and of concurrent events in general history as well, in order to properly orient himself in any particular period which he is studying.

It gives a new viewpoint to the subject when one learns that in the eleventh century, when the revival of the arts in Italy gave promise of the Renaissance, which was still several centuries ahead, and after London Bridge and Westminster Hall (as it was first called) had been built, Norman French was the legal language of England and the only language taught in the schools. And this was the closing period of Arabian domination of pharmacy and the period in which the medical school at Salerno was at its zenith of popularity and power.

It is important, too, to know that the same ecclesiastics who persecuted Koppernigk (Coper-

nicus), Galileo, and Bruno, were experimenting in private laboratories in the futile search for the philosopher's stone. This alchemistic frenzy lasted for nearly two centuries, the close of which was hastened by the explosive career of Paracelsus, who cried aloud that all the world might hear and heed, that "the business of alchemy was not to make gold but to prepare medicines." In this period pharmacy probably had reached its zenith as a mysterious esoteric calling.

Inspiration for the work has come, not through encouragement of those who seem to be interested in dead and musty subjects of bygone days, but from the collecting of "quaint and curious volumes of forgotten lore," and the pleasant and profitable evenings spent in their perusal. Much enthusiasm, on my own part, has arisen through contact with the writings and the lovable personality of Dr. Edgar Fahs Smith, who has done so much for the history of chemistry.

Popularity for a book like this is not to be expected; let it be its own excuse. If it makes friends for itself and for its subject-matter, so much the better. If it encourages among students and pharmacists some desire to know more of the history of their profession, it will then have been worth while.

C. H. LAW.

AUGUST, 1926.

CONTENTS

ILLUSTRATIONS

The illustrations in this book are almost entirely from original sources, being photographs of pages of books in the library of the author. A few have been taken from Peters' *Pictorial History of Ancient Pharmacy and Medicine*, published by G. P. Engelhardt & Co., of Chicago.

The illustrations are arranged chronologically as regards subject-matter. References will be found in the text to the page opposite which the illustration may be found, and upon each illustration referring to the appropriate page in the text.

FOUR THOUSAND YEARS OF PHARMACY

CHAPTER I

ANCIENT PHARMACY AND ITS EARLIEST SIDE-LINE—MEDICINE. SCIENCE IN EMBRYO

When our troglodytic ancestors commenced to subdivide their labors and assign to certain members of the family, clan, or tribe, specific duties connected with the common welfare, there was little opportunity to cast reproach upon the prehistoric pharmacist for the carrying of side-lines, for there was only one to carry—the practice of medicine.

The interdependence between pharmacy and medicine runs back through countless ages, and while the tendency toward specialization has effected a fairly clear separation, in our own time, of pharmacy from medicine, there is still some overlapping of jurisdiction and of practice as well.

The physician who fills as well as writes his own prescriptions, except in case of emergency or for some other satisfactory reason, is establishing a side-line in which he is usually not qualified,

either by training or by experience, to do justice to his patient in the manner and form in which the medicine is administered. It is the function and responsibility of the physician to diagnose disease and to recommend treatment. If medicines are required the wise physician writes prescriptions to be filled by competent pharmacists, for this is the pharmacist's particular province and specialty, for which he has been especially trained.

In the early days when both pharmacy and medicine were empiric in their practice there was not the evident need for their separation and the degree of specialization that exists today, when medicine requires from six to eight years of collegiate preparation and one year of guided practice (interneship), and pharmacy three years of collegiate preparation and three to four years of guided practice before the respective candidates can register under most State laws.

The earliest records of pharmacy go back to the days before Tutankhamun, who was laid away in regal splendor in the Valley of the Kings in that country where Isis and Osiris were the dominating deities. The oldest prescriptions are found in the hieratic writing (or writing of the priesthood) of ancient Egypt. There is some question whether those given in the Ebers Papyrus are older than the one on exhibition in

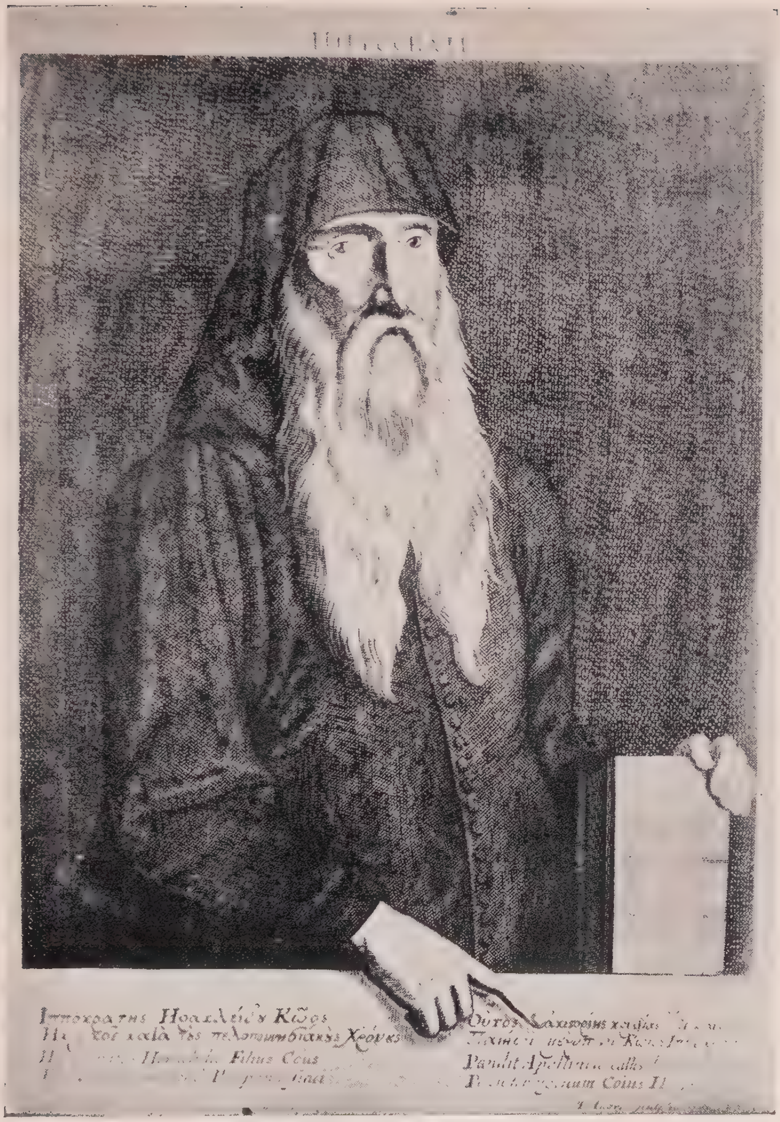


FIG. 2.—PICTURE OF HIPPOCRATES, FROM A SIXTEENTH CENTURY EDITION OF ONE OF HIS WORKS. SEE PAGE 39.

the Department of Egyptology of the Metropolitan Museum of New York, written upon stone, although not in hieroglyphic characters. There are several medical prescriptions in the British Museum which have never been translated nor photographed, and which are said to date from the time of Cheops, about 3700 B.C.

The stone tablet prescription of the Metropolitan Museum directs the preparation of a fumigation or vapor for inhalation, such remedies being in frequent use at that time. It calls for a precious green stone (identity unknown) which was to be ground up and then burned with the production of smoke. This smoke was to be inhaled for its remedial effects. The green stones were regarded as specifics in functional neurotic symptoms and several kinds were available, differing in price according to the financial standing of the patient.

The Ebers Papyrus (see illustration No. 1, frontispiece) contains a collection of prescriptions and formulas covering a wide range of uses. It is not, in any sense of the word, a pharmacopœia, as we now use that term, but is more of an unofficial formulary or private recipe book. It is in the form of a scroll twenty-two yards long, and about twelve inches wide, of yellowish-brown papyrus of the finest quality. It was pur-

chased by Georg Ebers, the famous German Egyptologist, in 1872 from an Arab of Luxor, who claimed to have discovered it between the knees of a mummy disinterred from the Theban Necropolis, then the resort of random treasure hunters instead of the official grave robbers whom we now call archæologists. The date assigned to the papyrus is about 1552 B.C.

At this time Moses was tending the flocks of his father-in-law, Jethro the Midianite, on the plains at the foot of Mount Horeb. This makes the recipes in the Ebers manuscript considerably older than the few formulas given in the Book of Exodus for certain preparations which were directed to be made "according to the art of the apothecary."

The translation of the Ebers Papyrus and other Egyptian writings had been made possible some years previous to its discovery by the finding of a large slab of basalt discovered by a lieutenant of Napoleon's expeditionary force in Egypt, near Rosetta on the Nile Delta, and later acquired by the British Museum, where it has since remained, and is known as the Rosetta Stone. This important link with the past was found upon examination to bear three sets of inscriptions. One of these is in the form of hieroglyphics or picture writing, as used by the priests only; one

in the kind of writing used by the common people, known as demotic; and one in Greek.

Scholars found it to be a threefold version of a priestly decree conferring divine honors upon Ptolemy V of Egypt, B.C. 195. The translation of the decree afforded the necessary clues for the deciphering of the written language of the Egyptians in both the hieratic or priestly form and in the demotic or profane style, and constituted the key to all subsequent research in Egyptology. It will therefore be seen that the discovery of the Rosetta Stone was a valuable by-product of the Napoleonic attempt at world domination and has a direct bearing upon the history of pharmacy.

The Papyrus contains many invocations and conjuring forms for driving away disease, as well as specific recipes, calling, in many instances, for drugs which are in common use today. Among those which have been identified are oil, wine, beer, yeast, vinegar, turpentine, figs, castor oil, myrrh, mastic, frankincense, wormwood, aloes, opium, cumin, peppermint, cassia, caraway, coriander, anise, fennel, saffron, lotus flowers, linseed, juniper berries, henbane, mandragora, poppy, gentian, colchicum, squill, cedar, elderberries, honey, grapes, onion, and date blossoms—a fairly representative collection. The identifica-

tion of many of these drugs is difficult because of the absence of any systematic nomenclature and because of the unusual and figurative synonyms which were in vogue. Thus, fresh dill juice was called " the blood of the ibis," while dill seeds were known by the name of " hairs of kynocephalus." The " heart of Bubastis " was the designation of wormwood, while squill was picturesquely described as " the eye of Typhon."

Among the mineral and metallic substances used by the Egyptians were iron, lead, bitumen, magnesia, niter, vermilion, copper sulphate, white lead, crude sodium carbonate, and salt—a very limited number. Precious stones were employed in a finely divided condition and there were special distinctions, according to the ability of the patient to pay. Thus, emerald was used for the plutocrat and green porcelain for the proletariat; lapis lazuli and sapphire were replaced in a similar manner by blue glass when occasion required. Jade and green glass have similar relative applications today, when used externally, but not for therapeutic reasons.

We shall see later on that the Egyptian influence lasted for thousands of years, for much therapeutic value is attributed to precious stones in the pharmacopœias of the seventeenth and eighteenth centuries.

The animal drugs included lizards' blood, swine's teeth, putrid meat, stinking fat, moisture from pigs' ears, milk, goose grease, asses' hoofs, animal fats from various sources, excreta of various animals, including human beings, donkeys, antelopes, dogs, cats, and even flies. The influence of this group also persisted for more than three thousand years, as may be seen by referring to many pharmacopœias of the sixteenth and seventeenth centuries.

Can you imagine an apothecary of today collecting fly-specks to fill a prescription? Shades of Ammon-Ra preserve us! This drug was used to prevent babies from crying and was mixed with the seeds of an unidentifiable plant—evidently the prototype of the soothing syrups of today.

Some of the prescriptions of the Ebers Papyrus are very simple. In those for purges they used a mixture of milk, yeast, and honey, or pills compounded of honey, wormwood, and onion. From the mildness of the doses we are compelled to the conclusion that the ancient Egyptians were not victims of chronic constipation. For headache there was used a prescription calling for frankincense, cumin, u'an berries (unidentifiable), and goose grease, which were to be boiled together and used as an external application. Again the compelling thought—were there

no "morning after" headaches in the days of King Tut?

There is one headache remedy attributed to divine origin (Isis having prescribed it for Ra's headache) which contains coriander, wormwood, juniper, honey, and opium. This would probably be effective, permanently so, if enough were taken.

As a prescription for a tonic there is recommended a preparation made by compounding figs, Assyrian plums, grapes, frankincense, cumin, wine, beer, yeast, and goose grease. If we leave out the goose grease and mix the other ingredients in such a way as to allow natural changes to take place, this tonic might even be popular at the present time.

A prescription, annotated as having been prepared for Schesch (a queen of the third dynasty), consisted of equal parts of the heel of an Abyssinian greyhound, of date blossoms, and of asses' hoofs, boiled in oil. This was for the purpose of making the hair grow. We wonder if something of this kind was handed down to the time of Cleopatra, when the use of cosmetics became popular. Certainly nothing even remotely resembling it is used today.

A remedy for baldness was prepared from a mixture of the fats of the horse, the crocodile, the

hippopotamus, the cat, the snake, and the ibex, which was to be applied freely. This was probably as effective as many of the hair restorers of the present time, although not quite so easy to obtain.

Some of the prescriptions of the Ebers Papyrus exhibited a tendency toward polypharmacy. There is a poultice with thirty-five ingredients. The directions for compounding and preparing some of the remedies for administration were very complicated indeed.

The pharmacists of ancient Egypt must have carried a full supply of worm medicines, for the Ebers scroll contains prescriptions for hookworm, tapeworm, seat-worms, and intestinal worms. They were also called upon to supply infusions, decoctions, macerations, fumigations, inhalations, gargles, injections, pills, powders, triturations, salves, plasters, confections, cataplasms, and poultices. One ancient remedy, comparatively little used at present, has come down to us through the centuries almost unchanged. This is a mixture of aloes and canella known by the Latin name of "*hiera picra*," literally "sacred bitters." While this attained prominence during the Grecian period, it probably came to them through the Egyptians.

A perfume called "kyphi," made in the

times of the Pharaohs from juniper berries, myrrh, frankincense, cypress wood, aloes wood, calamus, mastic, and styrax, came down through the writings of Dioscorides to later times and was used in religious observances, even in comparatively recent times in Europe.

The Egyptians used mortars of stone and wood, and containers of pottery and glass.

The knowledge of anatomy of the early Egyptians was necessarily limited, owing to their reverence for the human body and the severe penalties inflicted upon any who practiced dissection. Even the priests themselves were not permitted to make the incision in the abdominal cavity which was necessary in their embalming process, and this office was performed by an individual called the "paraschites," whose position in the community was comparable to that of the executioner. Despite their limited knowledge of anatomy, however, the Egyptians have recorded themselves as recognizing the pulse.

Herodotus, the Greek historian, writing in the fifth century B.C., says of the early Egyptians that "no doctor was permitted to practice any but his own branch," which would indicate that there were specialists even at that remote period. Egyptian records state the fact that the doctors

ΤΟΥ ΜΕΓΑΛΟΥ

ΙΠΠΟΚΡΑΤΟΥΣ

ΠΑΝΤΩΝ ΤΩΝ ΙΑΤΡΩΝ

ΚΟΡΥΦΑΙΟΥ ΤΑ ΕΥΡΙΣΚΟΜΕΝΑ.

MAGNI

HIPPOCRATIS

MEDICORVM OMNIVM

FACILE PRINCIPIS, OPERA

OMNIA QVÆ EXTANT:

In VIII. SECTIONES ex Erotiani mente distributa..

NVNC DENVO LATINA INTERPRETATIONE
& Annotationibus illustrata,

ANVTIO FOESIO MEDIOMATRICO MEDICO AVTHORE.

Adiecta sunt ad VI. Sectionem Palladii Scholia Græca in librum [illegible] *Latinitate donata.*

HIS PRÆTEREA ACCESSERE VARIÆ IN OMNES HIPPOCR. LIBR. LECTIONES
ex reconditissimis manuscriptis exemplaribus [illegible] diligentia collectæ, antea quidem partim Frobeniano Codici
Græce, partim verò ipsissimis Galeni Commentariis: nunc autem ip[illegible] textus paginis ac lineis summo cum labore
applicatæ: necnon etiam quorundam [illegible] Hippocr. libros Observationes.

HVIC NOVISSIMÆ OMNIVM [illegible]
Hippocratis libri de Medicamentis [illegible] *Item Erotiani*
& dictionum [illegible] *Indice*
eorum quæ in Hipp[illegible]

Cum INDICE QVADRVPLICI longe amplissimo & vtilissimo.

Typis & Sumptibus Samuelis C[illegible]

FIG. 3.—TITLE-PAGE OF A SIXTEENTH CENTURY EDITION OF ONE OF THE WORKS OF HIPPOCRATES. SEE PAGE 39.

were all priests and that they were paid out of the royal treasury, but were permitted to take fees also, and that there were penalties provided for adding to, diminishing, or varying in any way, the ingredients of a perfect prescription, which indicates that substitution was even then a recognized evil.

The total number of drugs mentioned in this remarkable collection of prescriptions is more than 700. Many of these are unidentifiable, but the entire number is much greater than in any modern pharmacopœia and probably greater than in all of the present-day pharmacopœias put together, for there is much duplication in the names of the drugs of different nations today.

The Egyptians must have had abundant faith in drugs and a knowledge of the art of compounding them. They are believed to have had extensive libraries of papyri or scroll writings prior to 4500 B.C. Of the medical papyri now in existence which have been identified, the most important are as follows:

1. The Kahun Papyrus, dating from 2000 B.C., which deals with gynecology and with veterinary medicine.
2. The Edwin Smith Papyrus, dating from 1600 B.C., which has been examined only in a preliminary way, but which gives promise of much that is of interest, for it deals with surgery and with internal medicine.

3. The Hearst Medical Papyrus, dating from about the same period as the previous one. This is a duplication, in part, of the Ebers Papyrus, which it antedates by some years.
4. The Lesser Berlin Papyrus, also dating from this same period, which deals particularly with magic and sorcery.
5. The Ebers Papyrus, dating from 1552 B.C., to which more extended reference has already been made.
6. The Berlin Papyrus, dating from 1350 B.C., consisting of twenty-three pages similar to parts of the Ebers Papyrus.
7. The London Medical Papyrus, dating from 1000 B.C. which is concerned with medicine and magic.

Of these, the Ebers Papyrus has been stated to be one of the missing books of Thoth. Thoth or Hermes, usually called Hermes Trismegistus or Thrice Greatest Hermes, is the reputed father of alchemy, pharmacy, medicine, and other arts and sciences. Our word "hermetical" comes from his name because the hermetic art, or the art of the alchemist, was one requiring vessels to be tightly sealed.

The ancient character of these manuscripts may be appreciated by a comparison with the original manuscripts upon which the Bible is based. The oldest manuscript of the New Testament is a Greek one in the Vatican at Rome, which dates from the fourth century A.D., and the

oldest manuscript of the Old Testament is one in a library at Leningrad (formerly St. Petersburg), which is attributed to the ninth or tenth century A.D.

The Egyptian goldsmiths and metal workers of the period contemporaneous with Greece were in rather bad repute on account of being clever imitators of precious metals. Indeed, the alchemistic vision of the transmutation of metals may have had its beginning in these ingenious Egyptian frauds of the pre-Christian Era.

The art of building dwellings, of weaving, of making pottery, of agriculture, the domestication of such animals as the cat, dog, and ox, were all practiced by the Egyptians, who probably acquired this knowledge from their Sumerian predecessors and passed it on to their successors. Their practice of mummification or embalming the dead was applied in several different ways, according to the wealth and standing of the deceased. The most expensive method, reserved, of course, for royalty, involved the use of myrrh, aloes, and aromatic drugs and spices, and cost a sum equivalent to $2500 of our money. A less expensive method, costing about $1500, employed herbs, salt, and oil. The cheapest method involved the use of lime, salt, and asphalt or bitumen.

While Europe was in the depths of barbarism

and Greece and Rome had not yet appeared on the horizon of civilization, the Egyptians had developed arts and industries in which they used the metals gold, silver, copper, iron, and the alloys bronze and electrum, the latter a mixture of gold and silver and believed by them to be a distinct metal.

They made use of the pigments lampblack, cinnabar, white lead, vermilion, and oxides of iron and copper, and employed the dyes known as madder and indigo. They were acquainted with the manufacture of glassware, enamels, and ceramics. They cultivated cereals, vegetables, flowers, and fruits. They developed such phases of geometry and arithmetic as were adapted to their needs for locating monuments, measuring lands, and calculating the contents of their granaries and storehouses. Their knowledge of astronomy, which was closely associated with their religion (the temples corresponding to the observatories), enabled them to divide the year into twelve months of thirty days each, although, strangely enough, they had apparently no conception of the rotundity of the earth. The knowledge of the Egyptians was essentially pragmatic and not at all speculative like that of the Greeks, who came later.

Egyptian pharmacy must have been primitive

and empirical to an extreme degree, and combined with a simple faith in magic spells and invocations to augment the effectiveness of a remedy. We smile at their credulity and yet in our own time, so far as American and English prescription practice is concerned, we use an abbreviation, ℞, which is distinctly traceable to the pagan symbol for Jupiter, ♃, which is said to have been used as an invocation on recipes by Chaldean physicians, at a time when the alphabet used by us had not yet been evolved.

The Babylonians and Assyrians, who were more directly related to the still earlier Sumerians, must also have had a specialized practice of pharmacy, for they had evolved a civilization contemporaneous with that of the later Egyptians and surpassing it in some particulars. These inhabitants of the alluvial plains of the Tigris and the Euphrates are said to have had libraries of flexible writing material of some sort as early as 3500 B.C. As mud was cheap, the clay tablets, which are now being unearthed and translated in such large numbers, were employed for many important records. The Code of Hammurabi, so frequently quoted as exemplifying ancient legislation, was a promulgation of laws carved upon an obelisk of stone for purposes of public information.

In the library of Sardanapalus at Ashurbanipal, which dates from about 650 B.C., have been found clay tablets relating to medical and pharmaceutical subjects. Their lists of drugs resembled the lists of the Egyptians. They were specialists in dietetics. Many of their remedies were directed to be given at the time of the rising or setting of certain planets, and most of them were administered in palm wine.

The writings of the Babylonians were in what is known as the cuneiform characters, so called because they were wedge-shaped. They were made with a hard, sharp-pointed stylus upon the clay tablets while the clay was in a plastic condition, and they were later baked to harden them and make them durable.

The second Babylonian Empire (about 600 B.C.) was several centuries later than the Homeric age of the Greeks. The Babylonians and Chaldeans were the first recorded classifiers of human knowledge, but they degraded astronomy into astrology and originated superstitions and misbeliefs which had an influence for many centuries. The Chaldeans had a very practical method in connection with the treatment of the sick. They exposed a sick member of the household in a litter by the highway in the hope that some passer-by might recognize the disease and recom-

mend a cure. This is about as scientific as the modern practice of advertising patent medicines along the highways in the hope that those who are ill may recognize the symptoms and purchase the remedy.

The symbol of the serpent, which has been adopted as the emblem of medicine in the "caduceus," played a prominent part in the healing ritual of both the Egyptians and Babylonians, and dates back to at least 4000 B.C. Those who have erroneously attributed it to the Greek Hermes or Mercury probably did not know or had forgotten that Hermes was the god of thieves and traders, evidently synonymous in those days.

We know less about the pharmacy of ancient China than we do of that of either the Egyptians or Babylonians. This is probably because the Chinese have always been uncommunicative and secretive to an unusual degree, and because there has been less research into the ancient literature of this living nation than into the literature of races that have disappeared. There is a pharmacopœia-like compilation in Chinese, called *Pun Tsao* or the *Great Herbal*. It consists of forty volumes and quotes from the works of nearly 1000 authors, many of whom date from a period far prior to the Christian Era. The science of medicine, which includes pharmacy, is referred

2

to as a benevolent art. The original authority is given as Shen Nung, the mythical god of medicine. Several thousand prescriptions are quoted in full in this ancient and important work.

The Chinese were the earliest to employ goose grease, the *adeps anserinus* of later pharmacopœias, as a preferable fat for inunctions. It is interesting to note that modern scientific research, applied to various fats to determine their penetrating power, places goose grease at the top of the list. Thus does science frequently justify the conclusions of empiricism.

There are many medical divinities in the religions of China. Of the seventy-two Buddhas, twenty-nine are gods of healing or of drugs. In Taoism, which is a philosophy of abstract virtue, a great part is played by the Yin Yang symbol, or Great Monad, which is a protective charm against evil. Taoism abounds with charms, lucky days, and perfect numbers. Rewards and punishments are abundant. Of one hundred and fifty separate and particular hells one is reserved for pharmacists and one for physicians. Probably there are separate sections in these for price-cutting druggists or prescribing pharmacists, as well as for " dope " sellers and dispensing physicians, and for the manufacturers of consumption cures and cancer cures. The thirteenth hell is

where the victims are perpetually forced to swallow hot disagreeable medical decoctions. In this branch of pharmacy the Chinese seem to excel. They use toads' eyelids for coryza and earthworms rolled in honey for gastritis. Centipedes are employed in children's diseases. One of their authorities is quoted as having said several thousand years ago that "if a medicine does not stir up a commotion in the patient, the disease will not be cured by it." Polypharmacy has always been rampant in Chinese practice and it is to them that we must go for the earliest belief in the doctrine of signatures, which played such a conspicuous part in medical practice in Europe only a few hundreds of years ago. There is said to have been an alchemistic literature in China at a time far prior to the period in which it dominated European thought.

Other Oriental countries also have their pharmaceutical lore reaching back into forgotten ages. Japan, India, Persia—all can claim a share in the common heritage of pharmaceutical practices and traditions.

Among the ancient Hebrews we have no very clear concept of pharmacy. In neither the Bible nor the Talmud is any great amount of attention given to either pharmacy or medicine. The most frequently quoted reference is that of Exodus

xxx–34: "And the Lord said unto Moses, Take unto thee sweet spices, stacte, and onycha, and galbanum; these sweet spices, with pure frankincense: of each shall there be a like weight: and thou shalt make it a perfume, a confection after the art of the apothecary, tempered together, pure and holy."

In this quotation the root word *rakach* (assuming the correctness of the vowels, for the Hebrew written language consists only of consonants) was originally translated "apothecary," but is now translated "perfumer," which seems more in keeping with the text.

The aborigines of America, the Amerinds, the Aztecs, and the Incas, all had their combination of priest-prophet-physician-pharmacist. They pursued many practices which, while crudely carried out, had a basis in scientific truth. Thus they were familiar with the tanning effect of oak bark and the cleansing properties of wood ashes. They used fish bladder and fish scales for making glue, and pitch and resin for water-proofing purposes. They knew the art of making pottery and the use of pigments. They employed hundreds of indigenous plants as foods, as flavors or condiments, or as drugs. In the former groups are the potato, the tomato, maize, chocolate, capsicum, and vanilla; in the latter group we owe

to the new world the drugs coca, cinchona, jalap, gaultheria, sanguinaria, lobelia, hydrastis, podophyllum, and many others.

What we have considered up to the present time is more or less involved in obscurity and speculation. It need not be discredited on this account for when we come to the later chapters which are based upon so-called historical records and documents, we must not forget that according to Sainte-Beuve "History is in great part a set of fables which people agree to follow." As a matter of fact, the people, meaning by that the readers of history, have little or no choice. They take what is given them by the historians, who in turn make what use they can of the records which are available.

History must always be read, therefore, with an open mind. Fiske says, "Great occurrences, such as the Trojan War and the Siege of Thebes, so faithfully described by all historians of Greece, have been found to be part of the common mythical heritage of the Aryan nations." In a history such as this we must keep our theme close to the great central idea of the development of pharmacy and of science, which underlies all professions.

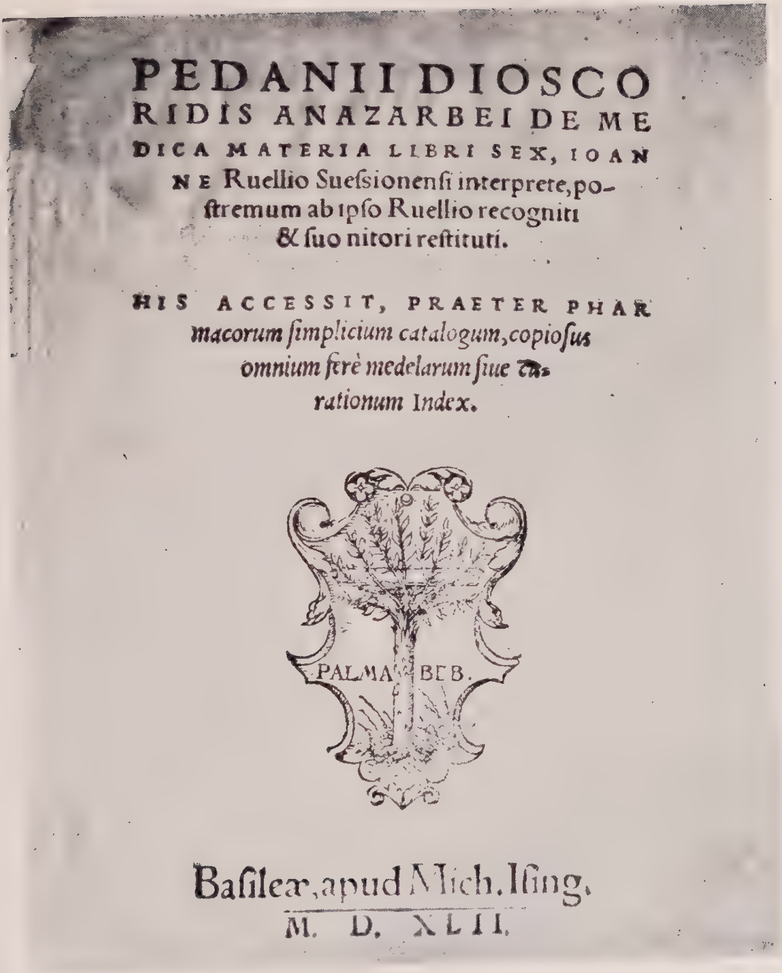
In the great structure of human knowledge, which may be likened to an immense museum in

which related subjects occupy stories, wings, or halls, according to their importance, science has in former times been relegated to the lumber room or attic. At present, however, a rearrangement has resulted in science being given a location very close to the main entrance, but unfortunately the exhibits are still catalogued in terms which are unintelligible to the majority of visitors and much of its value is thereby unappreciated.

Science, according to the dictionary framers, is "classified knowledge" or "an orderly arrangement of facts," or "systematic and formulated knowledge," all of which is another way of saying that a scientist is a classifier, interpreter, and arranger of facts. Science, therefore, as we know it, is essentially modern and it is an anachronism to speak of prehistoric science, although its foundation, as we shall see, goes back to the mists and obscurities of antiquity.

In studying the beginnings of science we must realize that much of the knowledge was erroneous, that true and false statements abound on every hand and are given equal weight in arriving at conclusions which are sometimes true and sometimes faulty, irrespective of the truth or falsity of the premises.

We shall find that in these early periods all knowledge was more or less confused, and that



PEDANII DIOSCO
RIDIS ANAZARBEI DE ME
DICA MATERIA LIBRI SEX, IOAN
NE Ruellio Sueſsionenſi interprete, po-
ſtremum ab ipſo Ruellio recogniti
& ſuo nitori reſtituti.

HIS ACCESSIT, PRAETER PHAR
macorum ſimplicium catalogum, copioſus
omnium ferè medelarum ſiue cu-
rationum Index.

Baſileæ, apud Mich. Iſing.
M. D. XLII.

Fig. 4.—Title-page of a sixteenth century edition of one of the works of Dioscorides. See page 63.

there was no differentiation between professions which exist separately today; also that there was an intermingling of religion and learning which not only hampered the development of science, but which later made a gulf so wide between orthodoxy and some branches of scientific knowledge that it has not been entirely bridged over, even in our own time. In fact, in Tennessee and a number of the other southern States they are now trying to dynamite the bridge.

We shall also find, as we go further along in this fascinating field of study, that early vagueness of thought was succeeded by positive ideas; that the formulation of general laws was succeeded by the recognition of others still more advanced; that each discovery made the next succeeding one easier, if it did not actually point the way to it.

In the contemplation of these things we shall find a fascination unequalled by ordinary or political history, for this is a history of intellectual achievement and not of brute force. We shall find also that science has often a most important influence upon the development of civilization, and indirectly on the rise and fall of empires.

Before knowledge can be classified and arranged it must first be accumulated. The collection of facts undoubtedly went on for thousands

of years before the discovery of the means of recording them, and in the mere assembling of knowledge there must be associations which imply classification to a certain extent, so the earliest existing records give evidence of a crude kind of scientific arrangement.

The making of rude implements by early man for warfare, the chase, or agriculture, the kindling of a fire, the tilling of the soil, the working of metals—all these date back to what we call prehistoric times, and yet all are closely connected with the development of science. We must also realize the difficulties that hampered primitive peoples who were without adequate means of acquiring or transmitting knowledge except by word of mouth.

Probably the earliest exhibition of interest in what we would call a strictly scientific subject is in the one which modern scientists call cosmogony, or the theory of the creation of the universe. This was intimately associated with astronomy and geography, and with the concepts of time and space and the invention of practical methods of measuring and recording them.

Who first made use of the pole-star for determining direction? Why do we have a week of seven days divided into hours of sixty minutes each? It is impossible to give a decisive answer to

either of these questions. The Egyptians, Babylonians, and Assyrians, as well as the Mayas of Central America, made use of the cardinal points of the compass in orienting their palaces, pyramids, and temples. The Babylonians also are credited, through tradition, with having used the twenty-four hour day and the seven-day week, the latter being based upon or associated with the incorrect assumption that there were seven important heavenly bodies—the Sun, Moon, Saturn, Jupiter, Mars, Venus, and Mercury.

It is extremely probable that the Egyptians and Babylonians both owed their knowledge of these and many other things of equal importance to the Sumerians, who are credited with being probably the earliest people to form real cities in any part of the world, and who attained their highest development in Mesopotamia, as the Greeks called the country between the upper waters of the Euphrates and Tigris Rivers and the Persian Gulf.

The accumulations of recorded knowledge of the Assyrians, Babylonians, and Egyptians remained unappreciated for several thousands of years, for it was not until after the discovery of the Rosetta Stone and its translation, early in the nineteenth century, and the deciphering of certain rock inscriptions in Persia shortly afterward

that the key to hieroglyphic and cuneiform writings became available.

In Persia at Behistun a trilingual rock inscription in the Babylonian, Elamitic, and Persian languages was discovered, and upon deciphering this the key to the writings of the Assyrians and the Babylonians was found. Nineteenth century scholarship, therefore, unlocked great stores of knowledge which had remained unappreciated for centuries on the obelisks and papyri of the Egyptians and the clay tablets of the Mesopotamians.

The mathematical ability of the Babylonians was far superior to that of the Egyptians and they had highly perfected systems of counting, weighing, and measuring. Among the trades and occupations represented in ancient Babylonia were importers, money lenders, dyers, fullers, tanners, saddlers, blacksmiths, silversmiths, goldsmiths, carpenters, shoemakers, stonecutters, ivory carvers, brickmakers, porcelain makers, potters, vintners, sailors, butchers, engineers, architects, painters, sculptors, musicians, and merchants of various kinds. They used the lever and pulley, lathes, picks, saws, hammers, operating lancets of bronze, sundials, and water clocks.

The earliest recorded attempts at classification of objects or of phenomena undoubtedly may be credited to the Mesopotamian peoples.

In ancient records they are found to have attempted classifications of animals, birds, vegetables, woods, minerals, precious stones, etc. The aptness of some of their classifications is found in the fact that they placed the dog and the wolf in one class, and the ox, sheep, and goat in another class among the animals. They are thus the earliest people who attempted a systematic study of what we now call natural history.

The later Chaldeans, who established the second Babylonian empire about 600 B.C., developed the alphabet, originated simple arithmetical processes, improved instruments for measuring time, encouraged sculpture, extended the production of textile fabrics, formulated a system of laws, and thus made possible the progress of the Greek, Alexandrian, and Roman periods which followed.

CHAPTER II

PHARMACY DURING THE GREEK, ALEXANDRIAN, AND ROMAN PERIODS. THE KINDERGARTEN OF SCIENCE

It can be seen by the foregoing chapter that the time was ripe for a new race to come who would utilize the wisdom of the ages and through the influence of a greater degree of intellectuality bring mankind's efforts to a higher plane of efficiency. Human genius had never been more confident nor more capable than when the Greeks, with their unusual powers of reasoning, utilized the reservoir of knowledge that had been collected by the Egyptians and Mesopotamians and directed it into new channels which were destined to have an influence upon all succeeding civilizations.

In astronomy it is recorded that the first prediction of an eclipse was made by the Greek philosopher Thales in 590 B.C. We are now arriving at a period where the records are so definite that we can ascribe certain discoveries or achievements to individuals rather than to races and to a definite time rather than to an epoch. The Homeric age of song and story had occurred

several centuries before (990 B.C.). Thales, a Milesian Greek, who lived in the sixth century B.C., was the earliest of the Greek philosophers and is also known as the father of Greek astronomy. He was first on the list of the Seven Wise Men of Greece. As to whether his prediction of the eclipse, before mentioned, was due to his astronomical or mathematical ability, or to a clever interpretation of ancient Egyptian and Babylonian records of eclipses, must remain in doubt. At all events, he can rightfully claim the distinction of being the first recorded absent-minded professor, for he is said to have walked into a pool of water of some depth while going along with his face turned toward the stars in blissful speculation.

Thales first recorded a number of important and fundamental geometrical truths, among which are the following:

1. That a circle is bisected by its diameter.
2. That the angles at the base of an isosceles triangle are equal.
3. That when two straight lines intersect, the opposite angles are equal.
4. That one side and one acute angle of a right-angled triangle determine the other sides of the triangle.

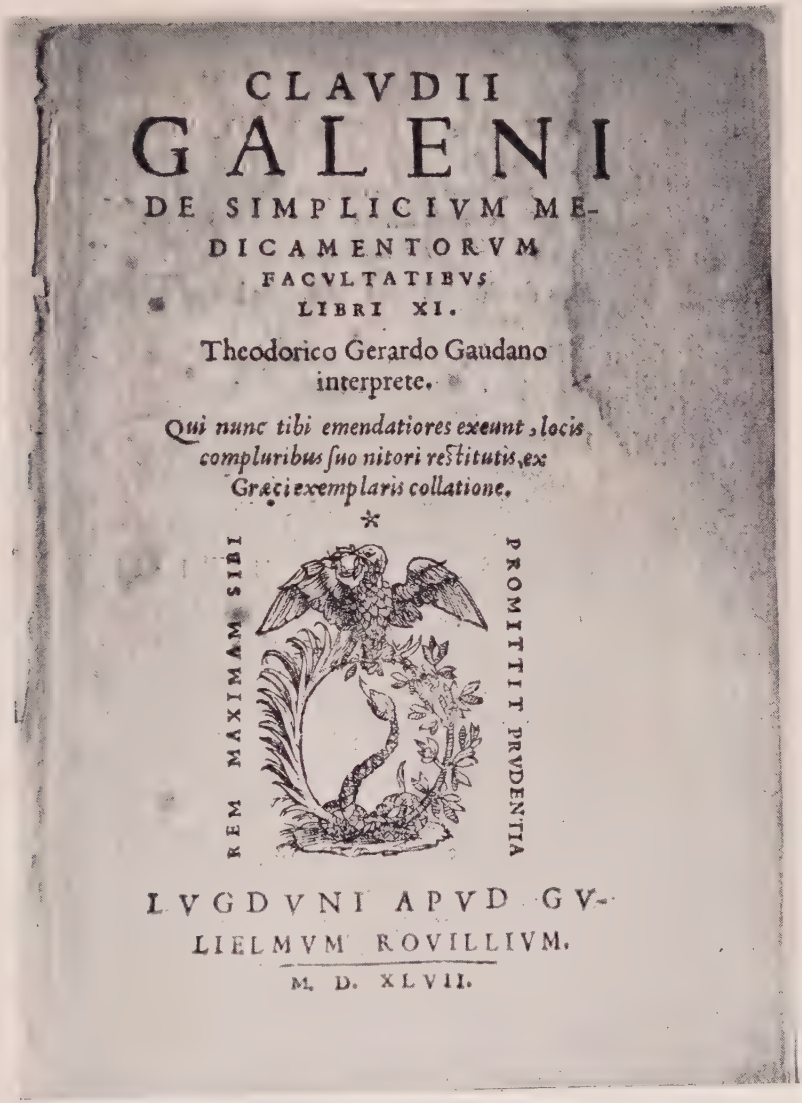
He first applied the principle of measuring

the height of an object by the relative length of its shadow in comparison with that of an object of known length. His breadth of knowledge must have been great and he is the author of the maxim so frequently quoted: "Know thyself." He is also said to have believed that water was the primary and essential element of all nature.

With respect to records, we are better supplied than was the case with the material for the previous chapter. And yet, when we realize the losses which civilization sustained in the destruction of great libraries and the accumulations of written records of the past, we must deeply regret the antagonism which was displayed toward science and culture for many centuries.

Almost every one has heard how Amru, the Mohammedan conqueror, after he had seized Alexandria, sent to Caliph Omar to know what should be done with the contents of the libraries. "If the books agree with the Koran," was the reply, "they are superfluous; if they contradict it, they are damnable; in either case, destroy them." So the priceless scrolls are reported to have been used as fuel to heat the water for the public baths, and so great was the number that they are said to have lasted for six months for this purpose.

One of the Alexandrian libraries had been accidentally destroyed some centuries before,



CLAVDII
GALENI
DE SIMPLICIVM MEDICAMENTORVM
FACVLTATIBVS
LIBRI XI.
Theodorico Gerardo Gaudano
interprete.

Qui nunc tibi emendatiores exeunt, locis compluribus suo nitori restitutis, ex Græci exemplaris collatione.

REM MAXIMAM SIBI PROMITTIT PRVDENTIA

LVGDVNI APVD GVLIELMVM ROVILLIVM.
M. D. XLVII.

FIG. 5.—TITLE-PAGE OF A SIXTEENTH CENTURY EDITION OF ONE OF THE WORKS OF GALEN. SEE PAGE 63.

when a conflagration on Cæsar's fleet set fire to this famous city of learning, and another was later destroyed by the Christian archbishops, Theophilus and Cyril, who figure so prominently in Kingsley's story of Hypatia.

The destruction of the libraries of Rome by the pagan hordes who overthrew that empire; the wholesale destruction of libraries by Valens, an early Christian zealot; the alleged annihilation of thousands of volumes by Genoese crusaders at Tripoli; the book-burning exploits of Torquemada, the head of the Spanish Inquisition; the bonfire of 80,000 valuable Arabic manuscripts kindled in the public square of Granada by Cardinal Ximenes; the irreparable loss of all Aztec records, destroyed by the early Christian bishops of Mexico—these are the fanatical acts which deprived the world of records of incalculable value, and make much more difficult the tracing of the history of the arts and sciences.

The pharmaceutical history of Greece begins with the mythology of that period when the gods and goddesses of Olympus provided material for song and story during many centuries to follow. The doings of these mythical characters are so inextricably woven with the lives of real characters that it is difficult to tell where fact begins and fancy ends. There are those who believe that the

secret of Nepenthes, that marvelous gloom dispeller of Homer's time, will some day be revealed in an ancient manuscript. According to others, an alchemistic secret is metaphorically and skilfully concealed in the story of Jason and the Golden Fleece, and some say that the latter was a book written on skins, containing an account of making gold by artificial means.

Chiron, the centaur, is the originator of the pharmaceutic art, according to the mythological tale. It was he who taught Æsculapius, another mythical character commonly accepted as the patron saint of medicine. In the Iliad, Homer refers in two places to Chiron as the originator of pharmacy. In the first, when Machaon cures Menelaus:

> " Then sucked the blood and sovereign balm infused,
> Which Chiron gave, and Æsculapius used."

and later where Patroclus treated the wound of Eurypylus and is requested by the latter to

> " With lukewarm water wash the gore away,
> With healing balms the raging smart allay,
> Such as sage Chiron, sire of Pharmacy,
> Once taught Achilles, and Achilles thee."

Pliny says: " The first herborist and apothecarie, renowned for the knowledge of simples and composition of medicines was Chiron, son of Saturn and Phylliria."

Chiron was reputed to have been the teacher of pharmacy to Achilles, Æsculapius, Jason, Odysseus, and others. Æsculapius and Hercules are said to be the forbears of Hippocrates, who was a real character of the fifth century B.C., and from whose period the history of medicine and pharmacy may be said to begin (see illustration 2, opposite page 2).

Bacchus or Dionysius, the father of the vine; Ammon, whose name is a reminder of the fact that sal ammoniac was first produced from camels' urine in the Libyan Desert near the temple erected to that deity; and Zoroaster, the founder of the fire-worshiping religious system of Persia, have also been credited with having originated the healing arts.

Æsculapius, the son of Apollo and pupil of Chiron the centaur, is the most important legendary character, whose form and whose emblem, the caduceus (serpents twining on a staff), originally carried by Hermes and dating from Egypt and Babylonia, are still seen in connection with medical insignia. His untimely end by a thunderbolt from Jove, for having presumed to develop his art so far as to raise the dead to life, led to an interesting series of complications which are entertainingly described in any work on mythology. Æsculapius is credited with having a lot of

children, of whom the most notable were Hygeia, representing health, and Panacea, representing medicine.

Prometheus is also connected with the early beliefs of medicine, and the legend of the bringing of fire from heaven and presenting it to mortals, which Prometheus is supposed to have done, is the earliest instance of the indignation of the priesthood at the dissemination of knowledge among the common people, and was punished by the gift to mortals called " Pandora's box," from which, it will be remembered, all human ills and distresses escaped, Hope alone remaining to mankind as a consolation, although in a distorted condition from being caught under the lid of the box in closing it.

Achilles, another pupil of Chiron, who is credited with having discovered the virtues of the plant which bears his name (which supposed virtues have long been repudiated by practitioners of medicine), and Morpheus, the god of dreams (after whom Sertürner named the active principle of opium), who was the servant of Somnus, the god of sleep, are also prominent characters in Greek mythology connected with medicine and pharmacy.

Let us now leave pharmacy for the present and consider the Greek influence upon science in

general. Beginning with Thales in the sixth century B.C., we enter one of the most remarkable periods known to history. An almost unbroken record of progress stretches down through the Alexandrian period, which began in the third century B.C., to the time of Galen in the second century A.D. Such was the daring of the speculative inquiries of the Greek philosophers, and such originality of thought was recorded, that had it not been for the blighting effect of the Dark Ages which followed the fall of the Roman Empire, the barons of Runnymede might have journeyed to the signing place in automobiles and King John might have radio-broadcast the essentials of the Magna Charta.

Let us just enumerate a few of these views, which might have been epoch-making had they been accompanied by material research instead of being of the armchair variety. In the sixth century B.C., Anaximander, a pupil of Thales, is credited with the improvement of the sundial, the construction of the earliest geographical maps of any value, and the first teacher of organic evolution, in that he held that man had developed from a fish-like ancestor. In the recent book by Dorsey, *Why We Behave Like Human Beings,* many corroborative details are given of this view of man's origin.

Pythagoras (550 B.C.), a Grecian philosopher of the fifth century, who was also a practicing physician, and Parmenides, a contemporary, were the first individuals on record to hold the opinion that the earth is a sphere. So far as can be ascertained, no Egyptian or Babylonian astronomer ever entertained this conception, although both astronomy and geometry were originated and developed by these races.

Pythagoras also enunciated the proposition that the square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides, a geometrical theorem which is still called the "Pythagorean proposition." Although a traveler in foreign lands, with every opportunity for wide observation, Pythagoras confined his labors to mathematics and philosophy, being the founder of the Italic sect of philosophers, because he became a voluntary exile from Greece and established himself at Crotona, Italy. He modestly refused the title "wise man" and was satisfied with that of "philosopher" or "lover of wisdom."

In the same century as Pythagoras, Xenophanes, a contemporary, expressed his belief that at one time much of the earth must have been covered by the sea for a long period, the proofs being the shells and fossils of undoubted mari-

time origin which are frequently found at inland and mountainous places. This idea lay dormant for nearly 2500 years before it was taught as a scientific fact.

Empedocles, in the same century, was the first comparative anatomist, and his observations were reaffirmed by Lamarck over 2300 years later in connection with the development of the theory of evolution. He is also noted as being the originator of the erroneous idea that all matter is composed of the four elements, earth, air, fire, and water, which theory, being affirmed and emphasized by Aristotle, influenced scientific thought and blocked real progress for many centuries. Corresponding with these elements were certain qualities. Thus:

Hot and dry = fire
Hot and moist = air
Cold and dry = earth
Cold and moist = water

A contemporary of Empedocles was Alcmæon, a pupil of Pythagoras, who maintained the doctrine that health is the equipoise, and disease the maladjustment, of such forces as heat, cold, dryness, and moisture. He is the first recorded dissector of animals, the dissection of human bodies not being practiced until late in the Alexandrian period. He maintained that goats

breathe through their ears. This error is supposed to be due to the fact that he had dissected a single goat which had had its ear-drums destroyed. These ancient investigators were often guilty of the same error as many of their modern successors—they rushed into print on a single case. Alcmæon, however, was the first to describe the optic nerve and the eustachian tube.

Empedocles must have had a crude idea of the circulation of the blood, for he says: " The heart lies in seas of blood which dart in opposite directions."

Prior to the time of Hippocrates the temples of Æsculapius were the repositories of pharmaceutical and medical lore. The priests of these temples were called Æsclepiades, and they claimed to be true descendants of Æsculapius himself. Prayers, hymns, incantations, and charms played a prominent part in the treatment employed by the Æsclepiades. The temples were always situated in lovely sylvan spots, preferably in the neighborhood of springs.

The patients were subjected to a rigorous regimen of fasting and abstention from wine. After much solemn preparatory ritual they were allowed to sleep before the altar, and any dreams that were experienced were interpreted by the priests, and medicines were subsequently adminis-

tered in accord with these interpretations. The offerings of the patients were gratuitous and many attestations of cures were recorded permanently upon the walls of the temples.

The beginning of the revelations of the secrets of the Æsclepiades immediately preceded the birth of Hippocrates. The Æsclepiades of the Roman period are said to have originated the phrase "*Curare cito, tuto et jucunde,*" which means to "cure safely, entirely, and pleasantly." This was used as the motto for prescription writing as late as the nineteenth century in representing the importance of the four parts of a perfect prescription, to which reference will be made later.

Greek medicine, therefore, really began with Hippocrates, who was born on the island of Cos in 460 B.C. The Greeks had learned more about anatomy than the Babylonians or the Egyptians, probably because of their frequent contact with severe wounds and broken bones received in the sanguinary wars for which they were famous. Even at this early period (the fifth and sixth centuries B.C.) there were several schools of medicine in Greece, quacks and charlatans were prevalent, and there are known to have been bone-setters, oculists and dentists. Some wealthy practitioners had dispensaries and private hospitals of their own.

Physic was even at that time divided into three schools. One school pinned its faith to medicines, one to diet, and one to physical manipulations. Compare these with the regulars, the food faddists, and the bone bouncers of today. Have the more than twenty-four centuries made much change in this respect?

The later Æsclepiades (for this sect and the temples of Æsculapius, as well, persisted for some centuries) used music, bathing, and massage in addition to vegetable drugs, which were usually administered in wine.

Hippocrates, however, is the one individual figure who stands out as having been instrumental in divorcing medicine and surgery from the supernatural. He was a keen observer, an accurate thinker, and a clear and concise writer, who said, among many other wise things: "Life is short, opportunity fleeting, judgment difficult, treatment easy, but treatment after thought is proper and profitable."

Dissection of the human body was still forbidden in his time and he was compelled to base his knowledge and comparisons upon operations confined to the lower animals. He introduced clinical records such as are in use today. His recognition of disease as a natural phenomenon, and his practice of diagnosis and prognosis as

Fig. 6.—Symbolic illustration of medicine, surgery, and pharmacy during the fourteenth century. From a work by Guy de Chauliac. See page 169.

we understand them now, entitle him to be recognized as the Father of Medicine. Some of his surgical methods are followed today with little or no change in procedure. That he appreciated the doubtful value in which the services of the physician are sometimes held is shown by the following quotation from one of his works: "The physician visits a patient suffering from fever or wound and prescribes for him. On the next day, if the patient feels worse the blame is laid upon the physician; if, on the other hand, he feels better, nature is extolled and the physician reaps no praise."

In the writings of Hippocrates nearly 400 simples are named as medicinal substances. According to the writings of Galen at a later period, Hippocrates is credited with showing much interest in pharmacy and to have said in this connection: "We know the nature of medicaments and simples and make many different preparations with them, some in one way and some in another." He made and used fomentations, poultices, gargles, suppositories, pills, lozenges, ointments, cerates, collyria, and inhalations. He had no knowledge of distillation. According to Galen, Hippocrates prepared his own medicines, and he practiced pharmacy as well as medicine. He was the first authority on record who wrote

especially on the subject of diet and who insisted upon it as being an important aid to recovery from illness.

His works were so much sought after that Ptolemy, in founding the library at Alexandria, commissioned his agents to purchase his manuscripts at any price, which naturally led to hundreds of forged manuscripts. The separation of the true from the false was attempted by Galen about 600 years later and his verdict is accepted by the scholars of today who have studied such as remain. (See illustrations No. 2 and No. 3, opposite pages 2 and 10.)

Hippocrates died at the age of ninety years, full of honors. A swarm of bees is said to have settled near his tomb; the honey from this hive was reputed to possess remedial virtues for centuries thereafter. This was an example of reversion to type, for Hippocrates himself would not have countenanced such a superstitious belief.

Nostrums were not unknown at the time of Hippocrates, for Ætius, a contemporary, described one called the "Collyrium of Danaus," and another called the "Cholical Antidote of Nicostratus." The greatest monument to Hippocrates, however, is the Hippocratic Oath, an example of idealistic precept which has never been surpassed, and which, as the common heritage

of medicine and pharmacy, serves as the starting-point for all codes of ethics, however modern they may be. The Hippocratic Oath is as follows:

I swear by Apollo the physician, and Æsculapius, and Hygeia, and Panacea, and all the gods and goddesses—and I make them my judges—that this, mine oath, I will fulfil as far as power and discernment shall be mine.

Him who taught me this art I will esteem even as I do my parents; he shall partake of my livelihood, and, if in want, shall share my goods. I will regard his issue as my brothers and will teach them this art without fee or written engagements if they shall wish to learn it.

I will give instruction by precept, by discourse, and in all other ways to my own sons, and to those of him who taught me, to disciples bound by written engagements and sworn according to medical law, and to no other person. So far as power and discernment shall be mine, I will carry out regimen for the benefit of the sick and will keep them from harm and wrong. To none will I give a deadly drug, even if solicited, nor offer counsel to such an end; likewise to no woman will I give a destructive suppository; but guiltless and hallowed will I keep my life and mine art. I will cut no one whatever for the stone, but will give way to those who work at this practice.

Into whatsoever houses I shall enter, I shall go for the benefit of the sick, holding aloof from all voluntary wrong and corruption, including venereal acts upon the bodies of females and males, whether free or slaves. Whatsoever in my practice or not in my practice I shall see or hear amid the lives of men which ought not to be noised abroad—as to this I will keep silence, holding such things unfitting to be spoken.

And now if I shall fulfil this oath and break it not, may the fruits of life and art be mine, may I be honored of all men for all time; the opposite if I shall transgress or be forsworn.

The terminology of pharmacy used from the time of Hippocrates down through the Alexandrian period included words derived from the same root which gives us "pharmacy" and its analogues. *Pharmakon* was at first used to denote a drug, medicine, or poison, and comes from an original root word meaning to mix. It was also associated with sorcery. In the translations of the New Testament of the Bible the word "*pharmakeia*" is usually translated "sorcerers." It has occasionally been translated "pharmacist,' but when this is done its context gives it a startling and unpleasant significance. Look it up if you do not believe.

A *pharmacopeus* was a poisoner or purveyor of toxic substances. The *pharmakopoloi* were traveling quack doctors. Now you know how Aristotle felt when Epicenus referred sneeringly to him as having been one of the *pharmakopoloi*. The *pharmakotribœ* were drug grinders. Last and worst of all, the *pharmakoi* were the condemned criminals.

The *botanologoi* of this period were the collectors of simples and the *rhizotomoi* were the root cutters. The Greek words *pantopoloi* and

kadolikoi were used to designate the places where pharmacy was practiced. It is interesting to observe that in this same period the Greeks used the word *electron* for amber, on account of its frictional power of attracting certain substances, and our word electricity and all of its derivatives date from this same period so rich in historic data.

Anaxagoras is another Greek philosopher of the fifth century B.C. who stands out as an enunciator of new doctrines. He asserted that the sun was a mass of burning iron, that the moon contained mountains and valleys, and was the first to explain its phases and to appreciate the fact that it shines by reflected light. He has been called the father of meteorology, because he was the first to teach that the winds are largely due to rarefactions of the atmosphere caused by the heat of the sun. He is also reported to have taught that thunder and lightning are caused by collisions and friction among the clouds, which, even if not correct, is a long step in advance of the previous beliefs of the supernatural character of these phenomena.

The thoroughness and accuracy of his observations are found in the fact that he asserted that "a certain amount of air is contained in water, and fishes breathe this air." He, too, was the first to appreciate the possibility of the inde-

structibility of matter, which is shown by the following quotation from his works: "The Greeks do not rightly use the terms coming into being and perishing, for nothing comes into being, nor, yet, does anything perish, but there is mixture and separation of things that are."

Following close upon the heels of Anaxagoras came Leucippus and his disciple Democritus, the Laughing Philosopher (420 B.C.), who were the authors of a theory of matter in which the word "atom" is first used. The atoms in this theory were supposed to be qualitatively the same and they differed only in size and shape. The union of different sized atoms in the multiplicity of possible combinations produces the diverse substances with which we are familiar. This theory, while agreeing in many respects with Dalton's atomic theory, had little effect upon Democritus' contemporaries, although Lucretius later gave it popular expression in his poetry:

"That you may know
That forms dissimilar coalesce in one,
And things are formed of differing elements;
As in our verse you many letters see
Common to many words, yet words and verse
As wholes dissimilar, ...
Thus common atoms may exist in things,
The compound whole be yet dissimilar."

Lucretius, De Rerum Natura.

FIG. 7. ILLUSTRATION OF A FIFTEENTH CENTURY PHARMACY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 175.

Like other theories of these early times, this one of Democritus lay unappreciated and for the most part forgotten for nearly 2000 years.

Herodotus the great historian belongs to this period between Hippocrates and Alexander.

Socrates, who died a victim of the hemlock cup, was in no sense of the word a scientist.

Plato (390 B.C.), the most notable pupil of Socrates, left very little of value to science, his chief interest being in speculative inquiry.

As Plato's greatest pupil and follower, Aristotle shone as a student and leader in natural sciences. He was born in 384 B.C., and was trained for the profession of medicine, as he came from a family of physicians. He was associated with Plato for upward of twenty years, but he did not agree with his teacher that the world of sense should be neglected in favor of the world of ideas. Absorbing much that was of value for his purpose from his master's teaching, he applied it in new directions and enriched many branches of knowledge by his work as a systematizer and coördinator.

Among the subjects on which he left his impress for centuries were astronomy, geography, meteorology, physics, chemistry, geology, botany, zoölogy, embryology, anatomy, and physiology. In zoölogy alone it may be noted that his classi-

fication of animals remained unchanged until Cuvier's system superseded it in the nineteenth century.

Neither was he idle in the world of ideas, for he gave attention also to logic, ethics, psychology, rhetoric, and political science. He was indeed "The Philosopher," as he was known for ages. His principal weakness lay in his blind acceptance of many theories with no attempt at verification or investigation. Through this error he was led at times to make dogmatic statements which we now recognize as being ridiculously incorrect.

He was reproached by his contemporaries for his undignified familiarity with facts, and that, having scattered his patrimony wastefully, he had become "a mere seller of drugs." This is the first instance on record of a specific individual being mentioned in connection with pharmacy as a separate art. He was probably trained in a knowledge of drugs by his father Nykomakos, who was the official physician of one of the Macedonian kings.

As the protégé of Philip of Macedon and the teacher of Alexander the Great (343 B.C.), Aristotle had it in his power to influence the world's political, as well as its scientific history, and although he later incurred the enmity of Alexander, the latter had, in founding the city which

bears his name, proved himself an apt pupil of Aristotle, for he carried forward the best of the scientific knowledge of the past and placed it in the hands of his successors.

Aristotle clearly put into words for the first time the idea of the earth as a sphere, as follows:

"As to the figure of the earth it must necessarily be spherical; if it were not so, the eclipses of the moon would not have such sections as they have;" and so on at some length. The rejection by Aristotle, however, of the possibility of the earth's motion, was a great detriment to the further progress of astronomy, which then lay dormant for more than ten centuries.

Theophrastus (390–280 B.C.), a disciple of Aristotle, was a philosopher who specialized in natural history. He has been called the "Father of Botany."

The influence of the group of students and workers attracted to Alexandria by Ptolemy Soter (307 B.C.) was felt in all branches of natural and physical science. Ptolemy, who had been one of Alexander's generals, although he assumed the title and responsibility of a monarch, found time to encourage learning and attracted to Alexandria scholars and philosophers from the entire civilized world. It was he who founded its most famous library and he also instituted schools of

science, and established an observatory, which work was carried on by his son, Ptolemy Philadelphus, and still later by Ptolemy III, 246–221 B.C.

Alexandria remained the center of wealth, power, and knowledge for over four centuries, and foremost among the names of those who made Alexandria famous is Euclid (300 B.C.), whose text-book on geometry remained unchanged for almost twenty centuries.

Another Alexandrian was Archimedes the Greek (240 B.C.), who was primarily a mathematician but whose name is inseparably connected with the discovery of the principle of specific gravity. He displayed great mechanical ability and was reputed to have invented more than forty machines. Among these were many engines of warfare, but the development of the compound pulley and the mathematical principles involved in the use of the lever are undoubtedly to be credited to him. He also figured out the ratio of the diameter of the circle to its circumference (commonly called pi, π) to a closer degree than had his predecessors.

The remarkable character of his work will be appreciated when it is understood that his calculations were all made years before the introduction of the so-called Arabic numerals and by means of a system in which no cipher occurred.

A contemporary of Archimedes was Aristarchus of Samos, another Greek, whose theories regarding the mechanism of the solar system were so nearly correct that had they been accepted by his contemporaries and successors, there would have been little for Copernicus to do over 1500 years later, nor need there have been necessity for the persecution of Bruno or Galileo.

Another Alexandrian Greek of remarkable ability was Eratosthenes (245 B.C.), the chief librarian of Ptolemy. He was the father of scientific geography and of scientific chronology, who, among other achievements, accomplished the wonderful feat of measuring the size of the earth at a time when but a small portion of its surface was inhabited by civilized races, or even known. And when we are told that the circumference of the earth, according to his measurements, was equivalent to 28,000 miles (only 3000 miles or a little over 10 per cent. from the truth), we must give him credit for a degree of ability almost unbelievable, considering the crudeness of his appliances.

In the period of scientific activity which began at Alexandria under Ptolemy Soter were some individuals notable for their effect on the progress of medicine and surgery. Among the first and most important of these were Herophilus and

Erasistratus, who were the first anatomists to really dissect and study the structure of the human body. Ptolemy himself was present at some of these postmortems, and among the discoveries which may be credited to them are the facts that the nerve trunks originate in the brain and spinal cord and that they are of two different kinds; also they described and designated the coverings of the brain and studied the anatomy of the eye. It is said that anatomical research was encouraged to such an extent under the Ptolemies that condemned criminals were handed over to the surgeons for experimental purposes.

The reason why surgery and anatomy did not make progress commensurate with these discoveries is found in the fact that, while these two investigators were accurate anatomists, they formed entirely erroneous conclusions regarding the functions and uses of many of the organs now seen for the first time. Herophilus had, with the positiveness only possible in those early days, located the soul in one of the four cavities of the body.

Hipparchus (160 B.C.), also a Greek, was the first to recognize the elliptical character of the earth's orbit, and he measured the length of the year within 12 seconds of the true year as now

recognized. He is said to have laid the foundations of trigonometry.

It was in the second century B.C. that paper is said to have first been made in China, but it was not brought to the Western world until many centuries later.

Ctesibius, and Hero his pupil, were also Alexandrian Greeks of the first and second centuries B.C., known for their contributions to the mechanical sciences. Among the achievements credited to the latter was a mechanism whereby the doors of a temple were caused to automatically open when a fire was lighted on a distant altar and close again when the fire died out, filling the pious worshippers with undoubted astonishment and adding to the power of the priests who were in the secret.

Hero also invented a crude form of steam engine, consisting of a hollow ball which was caused to revolve by the expulsion of jets of steam generated within it. This idea lay dormant for nearly seventeen centuries, when James Watt and his predecessors put it to practical use.

The first slot machine on record appeared among Hero's inventions and permitted the distribution of water for sacramental purposes by the introduction of a coin, which by its weight opened a valve that remained open until the coin slid off the lever and thus permitted the valve to

close. This slot machine of Hero is the prototype of the coin vending machine so commonly met with today, although its use disappeared for more than 2000 years.

It was about this same period (160 B.C.) that the sundial was superseded by the clepsydra or water clock as a means of measuring time in the Roman Empire, the first public sundial having been erected in Rome in 293 B.C. by Papirius Cursor.

The Greek period, as we have seen, covered more than 500 years, and with the annexation of Alexandria to the Roman Empire in 30 B.C., we enter upon the period of Roman supremacy. We shall find that the Greek-Alexandrian period which we have just concluded shows general science at the highest development it was to reach for more than a thousand years, for the Roman period, while it produced some great individuals, was one in which the decline that culminated in the Dark Ages was already marked. The Alexandrian period, given its impetus by the Greeks, soon came under the influence of the Romans and thus forms the connecting-link between the time of Hippocrates and the post-Galenic period, which was succeeded by that of the Arabians.

Improvements in recording and transmitting knowledge made their appearance during this

period. We get our word "paper" from the papyrus of the Greeks. Our word "parchment" comes from Pergamum, the city in Asia Minor whence this writing material came, which made its first appearance during the Alexandrian Era. Our word "library" comes from the Latin *liber,* meaning book and also bark, for the Romans used thin sheets of bark for records of a less important type. For ephemeral memoranda the Romans used tablets of wood coated with wax, upon which the writing was done with a stylus or pointed instrument. Our word "volume" comes from a root word meaning "rolled up," because the first volumes were scrolls like the papyri. Our word "book" is much more modern, said to be derived from the German *"buch"* for beech, because beechwood was used in making the early wooden type from which books were first printed.

The export of papyrus from Egypt, which had begun as far back as 2000 B.C., was continued until the third century of the Christian Era, when the raids of the Vandals annihilated the trade and the very production of papyrus ceased in Egypt in a short time.

Shortly after the time of Hippocrates came Cornelius Celsus, an important writer upon surgical, medical, and pharmaceutical topics. He recommended certain qualifications for the sur-

geon, who at that time was entirely distinct from the physician. He said: " He ought to be young, or at any rate not very old; his hand should be firm and steady and should never shake; he should be able to use his left hand with as much dexterity as his right; his eyesight should be acute and clear; his mind intrepid, and so far subject to pity as to make him desirous of the recovery of his patient, but not so far as to suffer him to be moved by his cries; he should neither hurry the operation more than the case requires, nor cut less than is necessary, but do everything just as if the other's screams made no impression upon him." This advice is just as sound today as it was over twenty centuries ago, when it was given, but what a picture it brings of suffering in the absence of anesthesia.

One of Celsus' prescriptions for preventing the decay of the teeth was called " sory." It consisted of poppy seed, pepper, and copper sulphate, made into a paste with galbanum. He also employed enemas of sea-water, and poultices of flaxseed or of foenugreek. Celsus was the author of a comprehensive encyclopedia on scientific subjects of all kinds. It was frequently quoted from by his contemporaries and successors and was lost for many centuries, but eight vol-

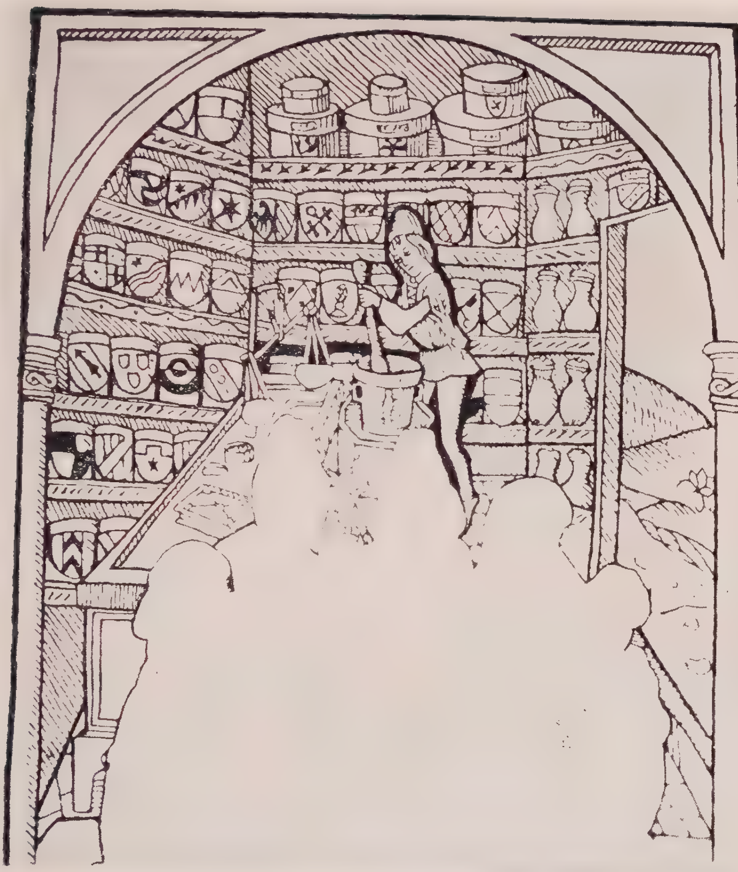


FIG. 8. ILLUSTRATION OF A FIFTEENTH CENTURY PHARMACY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine*. SEE PAGE 176.

umes of the work were found in the fifteenth century.

Serapion of Alexandria appeared about this time. It was he who selected the most revolting and unpleasant of the drugs used by the ancient Egyptians and passed them on to future generations, where they had an influence which lasted until the middle of the eighteenth century. This Serapion must not be confused with several other Serapions who appeared during the Arabian period.

In this post-Hippocratic period arose many sects and schools of medicine, among which were the Dogmatics, the Stoics, the Empirics, the Methodists, and the Eclectics. Some of these were still further subdivided, so that the complexity was evidently as great then as is complained of at present. The Dogmatics corresponded to the regular school of medicine of today. The Empirics introduced the famous *tripod,* or necessary factors for success in medicine, which consisted of observation, history, and analogy. This school was founded by Heraclides, who rejected anatomy as of no value and placed dependence entirely upon the use of drugs. He is credited with the earliest recorded use of opium as an anodyne in painful diseases.

The Methodists pursued a middle course; the

Eclectics based their superiority on the selection of what was best in all other sects; the Stoics were more or less indifferent to all human ills and infirmities and corresponded most closely with the faith healers of the present time.

About the same time reigned the famous Mithridates Eupator, King of Pontus, who was the first student of toxicology. He lived in such constant fear of being poisoned that he devoted his entire time to the study of the effects of poisons, experimenting upon criminals in his realm and also taking poisons and their antidotes himself. His experiments upon himself were so successful that on the day of his defeat by Pompey he attempted to commit suicide by poison, but had developed such a high degree of immunity or tolerance that the poison failed to produce the desired effect and he called upon one of his attendants to slay him, which he did.

Among the papers of the vanquished King, Pompey discovered the formula for the famous confection or electuary which at that time was called *Confectio Mithridates,* and was later improved by Damocrates, physician to Nero, after whom it was subsequently called *Confectio Damocratis.* It is said that the formula, as discovered in the fallen monarch's effects, called only for " twenty leaves of rue, a pinch of salt, two nuts,

and two dried figs." This was too ridiculously simple to inspire any confidence in its effect, so a more complicated formula was given out by Damocrates.

This was one of the most famous remedies of olden times and as introduced by Valerius Cordus in his *Dispensatory* in the sixteenth century, it contained nearly sixty ingredients. In its simplified form it was subsequently called *theriaca.* It will be discussed at length later on.

A famous later rival of theriaca or mithridate was called adrianus, which was invented by the Emperor Hadrian in the third century A.D. Hadrian was a dabbler in toxicology and pharmacy as a pastime and the formula for his product called for more than forty ingredients.

Damocrates is said to have originated a tooth powder famous in his time and for centuries thereafter, and to have also popularized many liniments, electuaries, poultices, and plasters.

Vegetius, a Roman physician of about the same period, wrote a book on the duties of army surgeons, which concerns itself mainly with hygiene and preventive medicine and pays little attention to pharmacy.

About the time of Celsus and Serapion the first Greek surgeon settled in Rome. His name was Archagathus. He was very well received at

first; a shop or dispensary was provided for him and he was given the honorable title of *Vulnerarius,* meaning "the healer." His reputation for resorting promptly to the knife and the cautery, together with the high mortality of his cases, soon led to the change of his title to *Carnifex,* meaning "the executioner." Archagathus was driven out of Rome by the indignant citizens and was succeeded by Æsclepiades, a graduate from Alexandria, who denounced drugs and the practice of bloodletting and who specialized in hydrotherapy.

In the Alexandrian and Roman periods came a new nomenclature of places, things, and practitioners. *Medicina* were drugs. A *medicamentus* was a medicine or a poison; it was also sometimes used as the name of the pharmacy itself. *Seplasia* was the Roman name for a pharmacy, the *apotheca* being the warehouse for drugs. A *medicamentarius* was one who prepared and administered drugs ordered by a physician. The term was also used to describe a poisoner. The *confectionarius* was the compounder. In Longfellow's Golden Legend we are reminded of this in the lines:

> "To report if any confectionarius
> Mingles his drugs with matters various."

We also meet the term in the edicts of medieval times.

The *seplasarius* was an ointment seller in particular. Pliny is said to have reproached physicians for having purchased medicines from the *seplasarii* without knowing their composition. The American Medical Association, in our own time, has had occasion to reproach some of its members for the same reason, when they prescribed proprietary secret nostrums, which some have done and still do. The *pigmentarius* was a seller of dyestuffs and colors; aloes was in those days classed as a pigment. The *circulatores* and *circumforanei* were traveling dispensers of medicine.

The Roman dispensers and compounders used mortars of earthenware (rarely of stone) with pestles of wood. They also used a form of grinding device called a quern.

In Alexandrian and Roman pharmaceutical practice they used infusions, decoctions, plasters, ointments, pessaries, powders, snuffs, troches, and other classes of preparations known and employed today. A class of preparations called *malagma* were non-fatty compounds of the consistency of ointments, for external application. Ointments called *eucharista* were applied as embrocations. The term *katapotia* or *catapotia* was applied to pills or small dosage forms of solid medicines. *Collyria* were used as eye prepara-

tions, as we do now, but the word also denoted a suppository-like form of medication.

Fees for medical and surgical services were fairly high. We have little or no knowledge of the pharmacist's prices, but it is practically certain that there were no cut-rate drug-stores, for there were no nationally advertised specialties and each practitioner developed his art individually, with such guidance as he could obtain from the manuscripts and volumes of former times.

Pliny was a Roman physician whose specialty was natural history. He also was the author of an encyclopedic work of which thirty-seven volumes yet exist. He was a compiler and not a creator, but his work was necessary to show those who followed after what had already been done. He lost his life in the crater of Vesuvius while making a close study of an eruption in 79 A.D. As a compiler, Pliny took what was given him without much critical selection. He believed that the drug called dragon's blood, which we know to be a gum-resin from an Oriental plant, was really made from the blood of a dragon which had been crushed to death by a dying elephant after a combat fatal to both animals. It is to Pliny that we are indebted for the frequently told story of Cleopatra's pearls, dissolved in vinegar, to fulfil

a wager that it would be possible to consume the value of a million sestercii at a single banquet.

Pliny was a naturalist who, in his encyclopedic compilation entitled *Natural History,* combined truth and error with such skill that the work is more interesting than valuable. The scientific or critical spirit of the Greeks is certainly wanting in one who is the author of the following:

> If the fish called the sea star is smeared with the fox's blood and then nailed to the upper lintel of the door, or to the door itself, with a copper nail, no noxious spell will be able to obtain admittance, or at all events, be productive of ill effects.

Pedacius Dioscorides was an early Greek physician who was an authority on materia medica and pharmacy, and who was probably a contemporary of Galen (see illustration No. 4, opposite page 22).

Claudius Galenus (or, according to some authorities, Clarissimus Galenus), commonly known as Galen, was the last great example of the Alexandrian school. He was born at Pergamum, Greece, in 130 A.D., and is supposed to have died in Sicily many years later. He was a celebrated philosopher, pharmacist, and physician, and was for many centuries the supreme authority in medicine and pharmacy. He was a great traveler and voluminous writer. He is supposed to have

written about five hundred works, of which eighty-three are recognized as genuine. These, with some which are doubtful, are still preserved in European libraries (see illustration No. 5, opposite page 30).

Between the time of the opening of the Christian Era and the period of Galen's activity, medicine and pharmacy had deteriorated very much. Great numbers of specialists had arisen, most of whom were charlatans claiming supernatural powers (a distinct retrogression). Many of these specialists (the *circumforanci*) traveled from place to place like the itinerant Indian herb doctors and their like of today.

Under Julius Cæsar, citizenship had been granted to all physicians practicing in Rome. As the Roman race deteriorated physically the physicians increased in power and numbers, until at the time of Galen, they were also granted immunity from taxes and military service. The Roman army had a branch of the service trained in emergency work corresponding closely to our Red Cross and Hospital Corps divisions.

Galen, by his studies and travels, had attained a high reputation as a surgeon and a physician before his thirtieth year. At that time dissections had again been forbidden by law (another retrogressive step), and he was obliged to confine his

experiments to the lower animals, reinforcing his knowledge, however, by consulting the works on anatomy by Herophilus and Erasistratus. Like these previous anatomists, his strong point was in his knowledge of the structure of the organs and not of their uses. He believed that the pulse was associated with respiration and that the arteries carried both blood and air. He also believed that conditions of health and illness were dependent upon the relative proportion of solids and liquids in the body.

This curious mixture of truth and error which pervaded Galen's works was accepted implicitly for many hundred of years and as late as 1560 we find that a Doctor Geynes was not admitted to membership in the College of Physicians and Surgeons in London "until he had signed a recantation of his error in having impugned the infallibility of Galen."

Galen's success as a practitioner caused bitter jealousy in Rome and he and his opponents had many wordy battles. As he changed his residence twice during his career, leaving the country each time, at periods coincident with the outbreak of plague, his reputation for courage is impaired. In this respect his behavior resembled that of the great Doctor Sydenham of London, in the seventeenth century. He is said to have kept a phar-

macy for a time in Rome and he originated so many preparations of vegetable drugs that such preparations are called " galenicals " or " galenical preparations " to this day.

Galen is said to have employed the fumes of orpiment, an arsenical ore, in the treatment of certain diseases. A prescription of his for toothache consisted of black pepper, saffron, opium, carrot seeds, aniseed, and parsley seed, to be made into a paste and placed in the cavity of the tooth.

The most famous preparation handed down to us by Galen, and referred to in the medieval pharmacopœias as *unguentum* or *ceratum refrigerans, Galeni,* is the well-known " cold cream " or rose-water ointment. Galen was a strong believer in the therapeutic value of wine and recommended that no wines be drunk unless at least seven years of age. It is said that wines which had been aged for a century were not uncommon at the tables of wealthy Romans of this time.

A bride's cake used at weddings during Galen's time and described by Cato was called *mustacea.* It contained aromatics and carminatives and was served at weddings to reduce the chances of indigestion caused by the usual over-indulgence upon such occasions.

Shortly before Galen's time, diachylon plaster had been popularized by Menecrates, physician

to Tiberius. The hieras had also come into vogue again. The word "hiera" was used generically to denote a class of preparations which usually contained aloes as the dominant ingredient, modified or disguised with aromatics. They dated from a very early period, and were originally sold as secret preparations or nostrums. One of the most noted of these was the hiera originated by Antonius Pachius shortly after the beginning of the Christian Era. It had such a vogue and acquired such a reputation that it is related by Scribonius Largus, physician to the Emperor Tiberius, that large sums of money were offered to the originator of the formula. Scribonius himself was the originator of a pharmaceutical formulary in the first century of the Christian Era.

Pachius kept his formula a secret until his death, after which the Emperor had his effects seized and his library searched to see if his recipe could be found. It was finally discovered in a manuscript which Pachius had dedicated to the Emperor himself. Tiberius handed the formula to Scribonius with instructions that it be published and preserved. It was found to contain colocynth or bitter apple in place of the commonly used aloes.

Other hieras which appeared during the succeeding centuries were those of Logadius, Archig-

enes, Theodoretus, Galen, Alexander of Tralles, Rufus, Justus, Mesue, Hermes, Rhazes, and of Constantine. Many of these were originally introduced as panaceas, or cure-alls, administered for every ill from leprosy to chronic constipation. The Arabs made one into pills which were used against the plague, and were known as *pilulæ pestilentiales* in the tenth century A.D. In the early editions of the Edinburgh Pharmacopœia in the seventeenth century, these pills were known as *pilulæ communis* (common pills), and were the forerunners of the present-day compound cathartic pills. There were six hieras in the *Dispensatory* of Valerius Cordus published in the sixteenth century.

The present official *hiera picra* is very much simplified in form, but we find that true of many of the older medicines, the name having been retained in many cases for preparations which contain but a small fraction of the original number of ingredients.

It was during the time of Galen and Dioscorides that the earths or clays became popular as remedial agents. Dioscorides described a number of varieties which were reputed to have different properties, according to their origin. These earths were natural forms of clays, of absorbent

FIG. 9.—ILLUSTRATION OF A FIFTEENTH CENTURY PHARMACY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 177.

properties similar to kaolin and other clays recognized in the pharmacopœias of today.

The most noted of these clays was *terra sigillata,* which literally translated means "the earth whose authenticity is established by a seal." Galen describes with much detail the method of obtaining the earth in the island of Lemnos, which he visited to ascertain the truth of the rumor that the earth from this locality was compounded with goats' blood during its preparation. This belief had erroneously originated from the fact that the figure of Artemis or of her symbol, the goat, had originally been imprinted upon the small blocks or tablets of the earth.

The clay from Lemnos was dug with great ceremony upon one particular day of the year only. The pit, which had been kept closed and guarded during the remainder of the year, was opened with solemn rites by the priests on the sixth day of August, six hours after sunrise. A quantity of the earth was dug which was estimated to meet the needs of the following year. It was carefully washed, dried, and then molded into small blocks, each of which was imprinted with the seal of its origin, and then sent to Constantinople for distribution. This earth was for centuries the monopoly of the Sultan of Turkey and the penalty of death was attached to opening

the pit on any other than the appointed day by the proper authorities.

Other "sealed" or imprinted earths were known both then and at later periods. *Terra Mellitea* came from Malta and was used especially for the bites of serpents. This earth bore the effigy of St. Paul upon each block, as St. Paul had landed upon Malta and blessed its soil. *Terra Portugallica* came from Portugal and was stamped with the figure of a rose. *Terra Germanica* or *terra Strigensis* came from Strigonium in Hungary and bore a design of mountain peaks and crossed keys.

Dioscorides describes six varieties. Some of these were reputed to possess distinctive properties; thus, the earth of Samnos was believed to absorb perspiration; the earth of Chios was used for cosmetic purposes, as it gave smoothness to the face and skin; and the earth of Koniolos was used especially in erysipelas.

A specially compounded preparation of an earth originated with a Greek physician named Polydias. It was composed of an earth, alum, myrrh, copperas, oxgall, and goats' blood, and was stamped with the image of a goat like the *terra Lemnia*. This preparation was called *sphragis pastilles*.

Clays are still official in a number of phar-

macopœias of the present time, although not imprinted with a seal. Kaolin is official in that of the United States, and *bolus Armenia,* a red clay, is official in some of the European pharmacopœias. The results of recent scientific researches have justified the use of clays as bactericides, due to their agglutinating effect on the bacteria, which are attracted and adsorbed.

Dr. Hermann Schelenz, the eminent German historian of pharmacy, states that the imprints on the various forms of *terra sigillata* were the earliest form of trade-mark.

An important factor in the development of complex medicines of the early Roman period was the quest for a universal antidote. The term *alexiteric* was applied to those which were considered efficacious against wild beasts, from *alexion,* to repulse, and *theria,* a wild beast. The term *alexipharmic* was used in connection with those which were considered as having antidotal properties against poisons in general, from *alexion,* and *pharmakon,* a poison. The most noted of these antidotes was the *confectio Mithridate,* to which reference has already been made.

These preparations were also called *theriaca,* or theriacs, a name which had been originated by Nicander of Colophon in the early Alexandrian period. He wrote two works in verse, one on

theriaca, which deals with the treatment of the bites of venomous serpents and animals, and the other on *Alexipharmics,* which deals with poisons that have been swallowed. These two terms were kept distinct by Galen, Dioscorides, and other early authorities, but in later times were used synonymously.

Nicander is the earliest authority to refer to the products of distillation. He mentions water distilled from roses and names the apparatus used as an *ambix.* This was the root word to which the Arabs later added the article "al," making the word "alembic." Nicander gives no description of the details of the operation, the first account of this kind being given by Synesius, Bishop of Ptolemais, early in the fifth century A.D.

According to Pliny, and corroborated by Galen, the formula for the theriac of Nicander was inscribed in verse on stone in the temple of Æsculapius on the island of Cos, the birthplace of Hippocrates.

Another theriac of wide popularity was that of Philon of Tarsus, who also recorded his formula in verse. The early practice of perpetuating formulas in metrical cadence was not for the æsthetic or literary effect, but to make them more easy to remember and to insure fidelity in transcription. This theriac contained as its most

notable and rare ingredient the "flesh of vipers," which is found in formulas of this character for more than 1500 years thereafter.

Philon, a physician of Tarsus, invented *Philonium,* a celebrated preparation which was used for centuries. It was composed of opium, saffron, pyrethrum, euphorbium, pepper, henbane, spikenard, honey, and other ingredients. Galen speaks highly of Philon's theriac. One of its ingredients was "the red hair of a lad whose blood had been shed on the fields of Mercury," and the names of other ingredients are also disguised in mystic language. It was directed to be made into a conserve with the "product of the daughters of the bull of Athens," which meant Attic honey. This theriac of Philon's was originally intended as a remedy for a peculiar form of colic which was epidemic in Rome at that time.

We shall meet the theriacs again in the fifteenth and sixteenth centuries, when they play a rather important part in pharmacy.

Besides the school at Alexandria, centers of learning were built up at Cyrene, Crotona, Cnidos, Rhodes, and Cos. From the ruins at Pompeii come records showing the use in the medicine and pharmacy of those days of aconite, acacia, colocynth, elaterium, garlic, anise, and mallow.

Poculi or " cups " were prepared—the *poculum amatorum,* or love draught, brought the seller, upon discovery, a decree of condemnation. Pliny states that in this period they not only used philtres for promoting love, but also philtres for quenching love.

Alchemy was practically unknown during the Greek and Roman period just concluded.

Much progress had been made in surgery and in medicine, but progress in chemistry began with the Arabian period.

Strabo the geographer was a prominent figure in the Alexandria of the Roman period. He suffered from a peculiar squint, which gave rise to the term " strabismus," used to this day by oculists to describe this affection. Strabo's work showed not so much originality as an ability to classify and arrange the knowledge which had previously existed. He entertained no doubt of the possibility of circumnavigating the globe and reaching India by sailing westward from Spain. His attitude was so matter of fact that it is surprising that this feat was not attempted and achieved, and it is probable that had it been, it would have seemed less surprising than it did nearly 1500 years later.

Vitruvius was an architect and engineer of the time of Augustus. He was employed by the

Roman Government and planned and built cathedrals and aqueducts and devised machines for use in both peace and war, among which were windmills, pulleys, pumps, fire engines, wheels for registering distance traveled, scaling ladders, catapults, etc. He wrote a series of ten volumes on engineering and architecture which comprised all of the Greek and Roman learning upon these subjects.

Vitruvius first described chronic lead poisoning, with which he became familiar through his observations of the effect of drinking water which had stood in lead pipes, for lead was used almost exclusively for this purpose. Our modern word "plumber" comes from the Roman word for a lead worker.

Julius Cæsar, in the first century B.C., with the aid of an Alexandrian astronomer named Sosigenes, succeeded in reforming the calendar by inserting an extra day every fourth year, which we know as leap year. Cæsar, who is better known to posterity as an historian, was also a writer on mathematical and astronomical subjects and planned a survey of the Roman Empire, which was executed by his successor.

Immediately after the beginning of the Christian Era (8 A.D.), Augustus Cæsar again cor-

rected the calendar, taking a day from February and adding it to August.

This was the period of the Golden Age of Roman literature, of Horace, Virgil, and Livy, and also the period in which the destruction of Jerusalem by Titus took place (70 A.D.), and the Jews were forced to become wanderers over the face of the earth.

It has never been definitely decided whether Dioscorides, the Greek writer on drugs, lived before or after Pliny. He was an authority for many centuries upon materia medica and described several thousand drugs in great detail. During this same time, the first century A.D., lived Tacitus and Juvenal, the authors, and Plutarch, who has been called "the unhistorical biographer."

Ptolemy, the Alexandrian Greek of the second century A.D., who is usually named Claudius Ptolemæus, and who must not be confused with the Egyptian line of kings of the same name, was a celebrated geographer and astronomer, who is noted particularly for the fact that he revived the geocentric belief in the earth as the center of the solar system as opposed to the heliocentric theories of Aristarchus, the Alexandrian Greek of several centuries previous. This perpetuation of error by so high an authority was undoubtedly

FIG. 10. —ILLUSTRATION OF A FIFTEENTH CENTURY PHARMACEUTICAL LABORATORY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 177.

responsible for the persecutions which resulted from the return, in the sixteenth century, of Copernicus and Galileo to the heliocentric theory now universally accepted.

Contemporaneous with Ptolemy was the period in which jurisprudence had its phenomenal rise in Rome and Hadrian's Code was promulgated.

Diogenes Laertius, the Greek historian, and the Emperor Marcus Aurelius are the closing figures of the second century of the Christian Era.

The review of early Greek and Roman pharmacy and science, up to this point, brief as it is, is interesting in showing that certain periods stand out in the world's history as important epochs. From the time of Thales, the first individual with whom we have to deal, to the time of Galen is barely 800 years, or not more than forty generations, and yet in that comparatively short period of time such progress was made as would have placed those who lived in the tenth and eleventh centuries where we are now, had it not been for the blighting effect of the Dark Ages which followed the fall of the Roman Empire in the fifth century A.D., as has been said before.

From the fifth century to the fifteenth, whatever progress was made in specialized science was made by the Arabs, among whom were astron-

omers, geographers, meteorologists, and scientists of many kinds. From the first century until the thirteenth, however, not a single name stands out of any great importance to science in its broadest sense. Some of the Arabs distinguished themselves in medicine and in alchemy, but the real underlying basis of science, which is a proper conception of the universe itself, was not advanced during this long period of more than 1000 years.

The veil of the Dark Ages was not completely lifted until the work of Copernicus, Kepler, Tycho Brahe, Bruno, and Galileo overthrew the erroneous Ptolemaic theory of the solar system, which had for more than a thousand years been firmly intrenched behind its ecclesiastical support.

Ptolemy and Galen were the last great figures in Roman science.

CHAPTER III

THE ARABIANS PRESERVE THE PHARMACEUTIC ART AND CARRY THE TORCH OF PROFESSIONAL AND SCIENTIFIC KNOWLEDGE FROM THE SIXTH TO THE THIRTEENTH CENTURIES

THE connection between the time of Galen in the second century A.D. and the time of Roger Bacon the philosopher, and Marco Polo the traveler, in the twelfth century, is by no means a direct one. In geometry a straight line is the shortest distance between two points. In history the direct route between cause and effect is often obscure or entirely hidden, and it is always full of digressions and interesting by-paths. The detours are frequently more attractive than the main highway itself. Thus we find the period in which the Arabs are responsible for the major portion of the route, one in which there is much that is interesting to the student of the evolution of pharmacy.

It was in this period that there appeared the first establishments in which pharmacy was practiced as a profession separate from that of healing, although this was by no means universal.

The knowledge of the Greeks and Romans was carried forward in spite of the opposition of the authorities, in many cases. The search for truth is sometimes stronger than the fear of persecution. The trail is sometimes lost because those who blazed it did so in secret. Botany, zoölogy, chemistry, and physics had not emerged as separate subjects of study.

The botanist was the physician-pharmacist who collected his own simples and subjected them to trial. The chemist was the physician-pharmacist who subjected mineral substances to various influences and observed and recorded the changes which took place. When we read the history of medicine we get the erroneous idea that most of these pioneers were physicians. In a history of chemistry these same leaders of thought are referred to as chemists. The true perspective is frequently lost by the average reader, to whom the terms "physician" and "chemist" are the restricted concepts of present-day followers of these professions.

We find pharmacy, therefore, inextricably interwoven with the history of medicine and of chemistry, with very few modern authors giving thought to the fact or even caring that pharmacy is thereby treated unjustly. Pharmacy has had but few to speak for her where scores have spoken

for the other professions. Writing has not been a sufficiently important side-line for modern pharmacists to take up. Why this is so is almost worthy of a volume in itself, so we must come back to the main thread of our story again.

It was shortly after the beginning of the Christian Era that the astrological sign of Jupiter, ♃, was generally placed at the head of prescriptions, a remnant of which sign still persists in the present abbreviation, ℞ (see illustrations No. 38 and No. 39, opposite pages 336 and 344). This practice was said to have been instituted by the physician Krinas, in the time of Nero, when Christians were so fiercely persecuted, to indicate the conformity of the physician with the state religion of Rome. At this time Christians were forbidden to practice medicine in Rome, and as late as the fourth century, in the reign of Julian, no Christian teacher was permitted in the medical schools.

In 330 A.D., Constantinople became the capital of the Roman Empire.

In the early part of the fifth century, Theon and his ill-fated daughter Hypatia taught Ptolemaic astronomy in the Alexandrian schools. In 415 A.D., a Christian mob, instigated by the narrow-minded and unprincipled Archbishop Cyril, attacked Hypatia as she was passing through the

streets, dragged her to one of the churches, and literally tore her into fragments and scraped the flesh from her bones.

Already the Roman Empire had begun to be overrun by the Visigoths, Huns, Vandals, and other barbarians. In 476 A.D., the conquest of Rome by the Germanic tribes was complete. This was about the time of Merlin, the famous necromancer of the Arthurian legends. It must not be overlooked that the Celts of Ireland had begun as far back as the fifth century to furnish some notable characters to religion, to science, and to speculative inquiry. One of these later was censured by Rome for teaching the sphericity of the earth. The Celts had learned the art of enameling upon metal, which, although known to the ancient Egyptians, was unknown to the classical nations until the third century, when it was introduced through the contacts of the Romans with the Britons.

The first six centuries of the Christian Era saw only a few names added to those which have already been mentioned. Among these few are Oribasius, a Greek author of the third century, who was court physician to the Emperor Julian, and who originated the idea of diseases being cured by the wearing of necklaces of certain types. He is frequently quoted by Rhazes and belongs to

the galaxy of Alexandrian Greeks; he was really a commentator upon the works of Galen. Aetius was another Greek of the fifth century, who was an authority on plasters and who was said to have first made use of the magnet in medicine. He was the first physician-pharmacist to embrace Christianity. In the works of Aetius, reference is made to several celebrated nostrums, one of which, a collyrium, sold for the equivalent of $500, and was scarce at that price; another was modestly named " isotheos " (equal to God).

Others who are mentioned in this period are Nemesius of the fourth century, who possessed a crude idea of the circulation of the blood; Ruffus, or Rufus, commonly called Rufus of Ephesus, who was celebrated for his anatomical studies; and Aurelianus and Leonides, who, besides being eminent surgeons of their day, are noted for first having proposed the isolation of contagious diseases. These were all included in what is known as the Byzantine period of Greek medicine and pharmacy.

After the destruction of Corinth in 146 B.C., many Greek physicians had established themselves in Rome.

One bright spot in this dark period of Christian antagonism to culture is found in the work which began under a broad-minded monk now

known as St. Benedict, who founded the order of the Benedictines early in the sixth century (529 A.D.) at Monte Cassino in Italy, and who set the brethren to work copying manuscripts and preparing treatises on grammar, rhetoric, arithmetic, astronomy, music, and geometry. In this way, Pliny's *Natural History* and many other Greek and Roman works of value were handed down to future generations. One of the Benedictine monks, St. Dunstan, is said to have been an alchemist, and being visited by the devil while pursuing his hermetic art, caught the latter by the nose with his crucible tongs and made him bellow so that he was heard for miles.

At about the same time Cassiodorus, the historian, statesman, and monk, was exerting his influence to carry the knowledge of the Greeks to future generations. He founded two monasteries where the members of the order were principally engaged in translating Greek manuscripts into Latin, and in preserving human knowledge from the destructive influences of the northern barbarians.

Alexander of Tralles, who lived in the sixth century A.D., used rhubarb as an astringent and cantharides as a blister. He also used colchicum in gout and reintroduced that then almost

FIG. 11.—FRONTISPIECE OF AN OLD EDITION OF THE *Triumphal Chariot of Antimony*, CREDITED TO BASIL VALENTINE. SEE PAGE 186.

forgotten combination of aloes and canella called hiera picra (literally sacred bitters).

In Mecca, about 570 A.D., Mohammed, the founder of Islam, was born. The Mohammedan calendar, however, dates from the Hegira or flight of Mohammed from Mecca to Medina in 622. This was the beginning of Arabian supremacy, which continued over a large portion of the habitable world for upward of 500 years, and which had an influence that lasted for many centuries thereafter. The Arab hordes swept over northern Africa first and in 642 captured Alexandria.

The major progress of the Arabians was along the lines of astrology, alchemy, and algebra, as has been aptly stated by Sir Oliver Lodge. In other directions they made progress also, but more along the line of classification and arrangement of existing facts than in the originating of anything new and startling.

The Koran, which was the first real piece of Arabic literature, was at first transmitted orally. Later, during the lifetime of Omar, it was committed to writing.

Within 200 years of the birth of Mohammed, Alexandria had been captured, Egypt and Spain conquered, and first Bagdad, and later Cordova, became the centers of learning of the then civil-

ized world. Cosmas and Damian, who date from the pre-Mohammedan period, and who are still regarded with veneration as patron saints of pharmacy in some European countries, were not fictitious characters, but their history is such a jumble of fact and fancy that they properly belong to the mythology rather than the history of the profession. The following account of these brothers is taken from Wootton's *Chronicles of Pharmacy:*

They were "Arabs by birth, but lived in the city of Egea, in Cilicia, in Syria, where they practiced medicine gratuitously. Overtaken by the Diocletian persecution in the fourth century, they were arrested and confessed their faith. Being condemned to be drowned, it is related that an angel severed their bonds so that they could gain the shore. They were then ordered to be burnt, but the fire attacked their executioners, several of whom were killed. Next they were fastened to a cross and archers shot arrows at them. The arrows, however, were turned from them and struck those who had placed them on the crosses. Finally they were beheaded and their souls were seen mounting heavenward. For centuries their tomb at Cyprus in Syria was a shrine where miracles of healing were performed, and in the sixth century the Emperor Justinian, who believed that he had been cured of a serious illness by their intercession, not only beautified and fortified the Syrian city, but also built a beautiful church in their honor at Constantinople. Later, their relics were removed to Rome, and Pope Felix consecrated a church to them there. Physicians and pharmacists

throughout Catholic Europe celebrated their memory on September 27th for centuries.

The Arabs owe their interest in medicine and pharmacy to several factors. They had penetrated the Orient and established contacts as far east as Borneo and China. The true relation of Chinese lore to Arabian learning has never yet been fathomed. The Arabians learned some of their anatomy from the Chinese, for a Chinese physician, Pien Ch'iao, had dissected the human cadaver some time before the Alexandrians and had elaborated a system of the pulse, used by Chinese physicians even up to modern times. The Arabs are indebted for much of their acquaintance with Greek learning to the Nestorians, those Syrian members of the Christian faith who followed the guidance of Nestorius the Patriarch of Constantinople, and who had their principal center in Edessa in Mesopotamia. Being persecuted by orthodox Christians and Mohammedans alike, they fled to Persia during the time of Justinian, from whence some of the leaders of Arabian teaching emanated. The first Nestorian college was in Dschondisabour in Nishapur, some time prior to Mohammed. A book of pharmaceutical formulas compiled by Sabor en Sahel, the director of this school, was authoritative for

hundreds of years and was imitated in the Middle Ages.

The game of chess had been introduced from India in the early part of the sixth century and had become a part of the training of physicians and probably also of pharmacists, for it was frequently recommended as a method of treatment. I wonder how many pharmacists now could fill a prescription for a patient which called for a game of chess.

The writings of the Nestorians were in Aramaic or Syriac. The teachings of Hippocrates and of Galen, which had been thus preserved through manuscripts that had escaped the wholesale destruction of books at Alexandria, were translated into Arabic by John the Grammarian and Aaron the Presbyter in the seventh century. They furnished much of the material which was used by the Arabians, particularly those of the Eastern Caliphate at Bagdad. Aaron's *Pandects of Physic* comprised thirty volumes, and while frequently quoted by Rhazes, no original copy has ever been found.

The intolerance of Omar toward learning, which had been exemplified by his attitude toward the Alexandrian library, was shared by the great proportion of the Mohammedan masses, who looked upon the Arabic-speaking philos-

ophers and men of learning with suspicion. Much of the early Arabian medical practice was based upon amulets. These healing devices date all the way back to Egyptian Hermes or Thoth, one of whose books dealt with *The Thirty-six Herbs Sacred to Horoscopes.* Even Galen could not stomach such nonsense and had warned against it. The Arabic amulets of earlier times consisted of a phrase from the Koran, written by the priest on papyrus (and later on paper). This was then put up in a leather or metal case and worn constantly as near the afflicted part as it was possible to keep it. It was necessary that the amulet must have been written by the priest on a Friday, shortly before sunset, and with ink containing certain drugs, as myrrh and saffron.

An interesting modern type of written charm in use at present, in Khordofan, consists of a "Lohn" or writing board, upon which phrases from the Koran or mystic inscriptions are written. When the writing is dry it is washed off and the fluid is taken internally or applied externally, as the case requires. A famous classical amulet of the Roman period following Galen was the "abracadabra." This was made and used as follows:

Write several times on a piece of paper the word "abracadabra," and repeat the word in the lines below, but

take away the letters from the complete word and let the letters fall away one at a time in each succeeding line. Take these away ever, but keep the rest until the writing is reduced to a narrow cone. Remember to tie the papers with flax and bind them round the neck.

Here are several forms in which this charm was written:

A B R A C A D A B R A	abracadabra	ABRACADABRA
A B R A C A D A B R	abracadabr	BRACADABR
A B R A C A D A B	abracadab	RACADAB
A B R A C A D A	abracada	ACADA
A B R A C A D	abracad	CAD
A B R A C A	abraca	A
A B R A C	abrac	
A B R A	abra	
A B R	abr	
A B	ab	
A	a	

The significance of this apparently meaningless word is explained by Hoefer in his History of Chemistry, who states that ABRA are the initial letters of the Hebrew words for Father, Son, and Holy Spirit, and that CAD are the initial letters of the Greek words for the Trinity, so the amulet takes on a religious aspect which few have appreciated.

Upon the assassination of Omar in 644, the succession of the Caliphate was contested by rival claimants representing two great factions. Both

were successful, in that the Caliphate was divided. He who succeeded to Omar directly moved his Caliphate from Mecca to the ancient city of Damascus. The other faction, mainly composed of Syrians, overran Spain and founded the Caliphate at Cordova, and later established Granada and built the Alhambra.

The Eastern Caliphate was subsequently moved from Damascus to Bagdad, made famous by Burton's Arabian Nights, where the Caliph Haroun al-Raschid instituted the Golden Era of the Eastern Caliphate in the early part of the ninth century. Under his stimulation a famous university was founded and libraries and schools abounded.

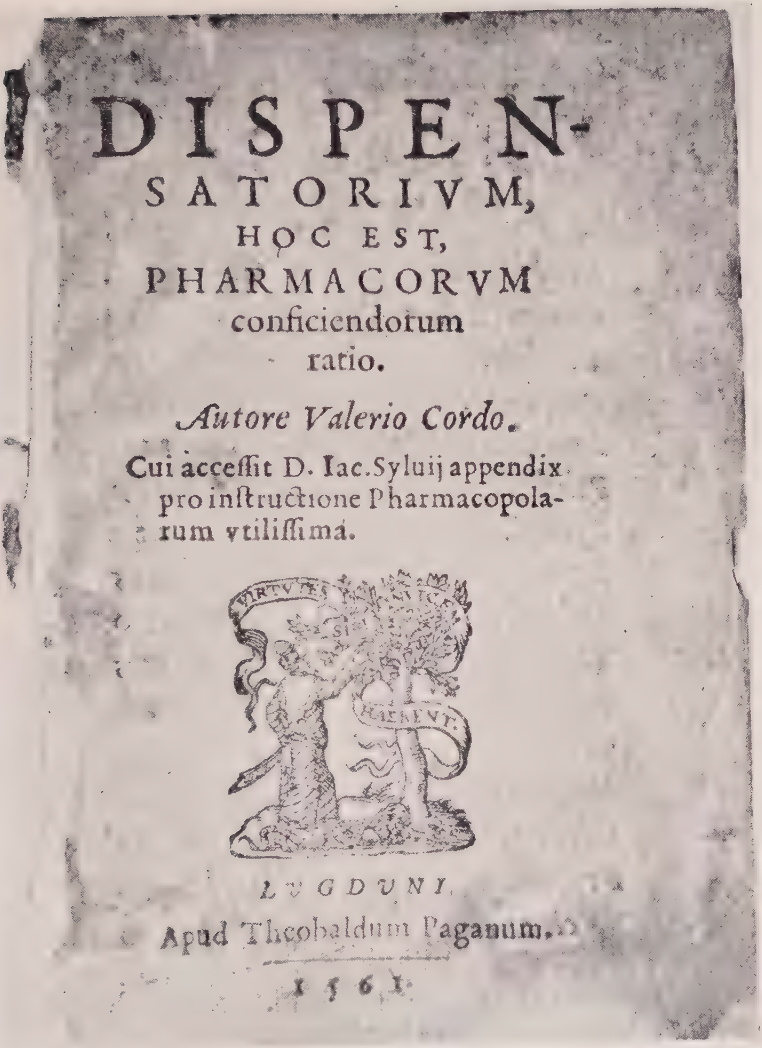
The scientific and philosophic treatises of the Greeks were translated and utilized, but the licentious poetry and irreligious mythology were shunned by the Arab translators. Medicine, pharmacy, and chemistry seemed to have a peculiar fascination for the Arabs, and greater progress was made in these than in most other branches of learning. Hospitals were established in the city of Bagdad by Caliph Haroun al-Raschid, and separate pharmacies or dispensaries made their first recorded appearance. The licensing of physicians began under his reign also and it is

said that nearly 1000 members of this profession were granted licenses in Bagdad alone.

The intolerance and repression of learning, so characteristic of the period of Omar, entirely disappeared in less than two centuries after his death, and the Caliphs of both the Eastern and the Western groups welcomed and invited Christians, Jews, and Pagans to teach in their universities.

There was some contact between Islam and Christendom in the days of Charlemagne, who was a contemporary of Haroun al-Raschid, and who was the founder of the Holy Roman Empire in 800. The Mohammedan ruler sent envoys to France with gifts of precious drugs and spices, and it was said that Charlemagne paid an incognito visit to Bagdad. France was at that time noted for its ignorance, profligacy, and misery, conditions which were in sharp contrast to those in countries under Moslem rule.

Paulus Ægenita, or Paul of Ægina, was the last of the Greek medical authorities. His period was about contemporaneous with that of Omar. He is particularly noted for his famous list of *succedanea* or substitutes, which included more than 200 titles of drugs. In some cases two, or even three, alternates were given. Many of the medical authorities after him gave lists of drugs



DISPEN-
SATORIVM,
HOC EST,
PHARMACORVM
conficiendorum
ratio.

Autore Valerio Cordo.

Cui accessit D. Iac. Syluij appendix
pro instructione Pharmacopola-
rum vtilissima.

LVGDVNI,
Apud Theobaldum Paganum.

1561.

FIG. 12.—TITLE-PAGE OF ONE OF THE SIXTEENTH CENTURY EDITIONS OF THE *Dispensatory* OF VALERIUS CORDUS. SEE PAGE 229.

which might be substituted by others. These are sometimes under the chapter heading "*Succedanea*" and sometimes under "*Quid pro quo.*" The practice of substitution, therefore, was one which was originated and encouraged by physicians themselves. The inclusion of these lists of permitted substitutes continued for more than a thousand years and many of the pharmacopœias of the sixteenth, seventeenth, and eighteenth centuries contained them.

A glance at some of Paul of Ægina's substitutes will convince one that while in some cases there is similarity, in other instances the resemblance is remote.

Aconite—the root of wild orris
Starch—dried flour
Fox's grease—bear's grease
Vulture's dung—pigeon's dung
Conium—coriander
Lovage seeds—carrot seeds
Poppy juice—mandragora juice
Rice—barley
Hyena fat—fox's fat
Henbane seed—sweetbrier seed
Hyena gall—partridge gall

The Arabians perpetuated the polypharmacal combinations which had come down from the Egyptians, in consequence of a complicated

theory of medicine and pharmacy taken in part from the Æsclepiades, in which a proper remedy for any disease shall contain

1. The base
2. Adjuvants
3. Synergists
4. Elements which might be replaced by *Succedanea*

The academies and schools of the Arabians were patterned upon those of Alexandria. It has been said that Arabian medicine is a composite blend of Greek medicine (which came through the Nestorians), of the medical practice of the Jews (obtained by direct contact with these people), and of the astrology and occult lore of Egypt and India.

The first of the great Mohammedan authorities was the one whose name is variously given in Arabic, but which is usually contracted and anglicized as Geber. The more than 200 works attributed to him have raised a doubt in the minds of some authorities whether he existed at all. Those of his works which are in Latin are probably spurious, and are certainly not originals. Some genuine Arabic manuscripts have been found which are attributed to him, but not all of these have been translated. If Geber did exist, then he is entitled to be considered as the father of chemistry.

Chemistry, according to etymologists, is derived from the root word *khem*, the native name of Egypt, where the science had its reputed beginning. This root word means "black," in reference to the color of the rich soil of the Nile Valley, so that literally chemistry has had some reason to be called "the black art" in later days. The earliest use of the word "chemistry" appears to be in the manuscript of an author named Sextus Julius Africanus, in the third century A.D. It was also called the "hermetic art," after the Egyptian Hermes Trismegistus. The practitioners were called "spagyrists" by Paracelsus, so it became known as the spagyric art in the sixteenth and seventeenth centuries. The Arabians attached the prefix "al," so we have alchemy or alchymy, as well as chemistry or chymystry, as it was at one time called. Who was the first chemist or "alchymist" in history?

Some of the early writers on chemical subjects claim to have traced the art back to Adam, others to Tubal Cain, and still others to Shem, the son of Noah, stating that the original form of his name was "Chem," and reasoning therefrom that the word alchemy was thus derived. Other writers did not fail to include Moses, for he proved his rank as an adept when he reduced the golden calf

to a condition of potability and gave the children of Israel the first "gold cure."

Solomon, of course, was credited with esoteric knowledge concerning transmutation. Ophir, the alleged source of his supplies of gold, silver, precious stones, ivory, apes, and peacocks, was so far distant that his fleet required three years to make a return trip. These early historians of chemistry state that so far as gold was concerned, Ophir was but a subterfuge and that he made the gold in his laboratories and had it carried to Ophir and back to mislead the world concerning its real origin.

Hermes of the Egyptians, who has been referred to as the possible author of the Ebers Papyrus, is reputed to have left a number of manuscripts. The subject-matter is concerned with metals and alloys, glassmaking, and the manufacture of medicines. Alexander the Great is said to have discovered the tomb of Hermes near Hebron, and found therein a slab of emerald upon which was written in thirteen sentences the essential secrets of alchemy in metaphorical language. Hermes is alleged to have presented the jewel to Sarah, the wife of Abraham, after which all traces were lost for many centuries. The traditional wording of parts of the inscription was

handed down among philosophers and adepts for many centuries as inspiration for the search.

The message on the emerald tablet has been found in three variant forms in ancient manuscripts. The one most commonly quoted is as follows:

> True without lie, certain, and most true. That which is below is as that which is above, and that which is above is as that which is below, for accomplishing the miracles of a single thing. And as all things were from one, by the meditation of one, so all things were born from this one thing, by adaptation. The father of it is the Sun, the mother of it the Moon. The wind bore it in its belly. Its nurse is the earth. The father of all the telesmus of the whole world is here. Its force is unimpaired if it is turned into the earth. You will separate the earth from the fire, the subtle from the dense, carefully and with great ingenuity. It ascends from the earth into the sky and again descends to the earth, and it receives the force of things above and of things below. So you will have the glory of the whole world, and so all obscurity will fly from you. Here is the strong fortitude of all fortitude, for it will conquer everything subtle and will penetrate everything solid. So the world was created. Hence there will be marvelous adaptations of which this is the mode. And so I am called Hermes Trismegistus, having three parts of the philosophy of the whole world. It is complete what I have said concerning the operation of the Sun.

The technical secrets which were handed down through generations of Egyptian metal workers,

jewelers, glassmakers, and potters were not embodied in any writings as yet discovered, but it is believed by some historians that the Egyptian lore was transmitted to the artisans of Greece and of Rome and was later acquired by the Arabians from these sources.

It is not certain that Egyptian metal workers believed in the transmutation of metals or sought to accomplish it. They were clever in working with the metals of their time and had named a white alloy of 20 per cent. silver and 80 per cent. gold "electrum," in the possible belief that it was a distinctive metal. They knew that arsenic possessed the property of changing the color of certain metals and that the presence of cadmium made copper look like gold.

Such early documents as have been discovered and preserved, having to do with metal working, date from about the third century A.D. and are probably those referred to in an edict of Diocletian, who in the fourth century ordered all books dealing with the making of gold and silver to be burnt. It is probable that the cleverness of the jewelers, the goldsmiths, and the silversmiths, in the matter of imitating metals, was the causative factor back of this decree. It will be remembered that Archimedes' dramatic discovery of the utilization of the principle of specific gravity in the

differentiation of base and noble metals had its inception in the need for proving the genuineness of the crown of King Heiro of Syracuse in the third century B.C.

The Mesopotamians had converted astronomy into astrology, and it is probably their influence that led to the association of the planets and the metals, which had developed shortly after the Christian Era, and which persists in the nomenclature of metallic salts even to our own time.

The original classification included electrum. The earliest coupling of heavenly bodies and metals was as follows:

Sun	gold
Moon	silver
Jupiter	electrum
Mars	iron
Venus	copper
Mercury	tin
Saturn	lead

When, shortly before the time of Geber, electrum was found to be an alloy, tin was transferred from Mercury to Jupiter, and quicksilver, which had been given no place previously, was ascribed to Mercury. The latter is the only one in which the name still applies to the metal without change. In the compounds of many of the other metals we still find names pointing to these early associa-

tions. Pharmacists and physicians still call silver nitrate " lunar caustic " ; iron-rust is still sometimes referred to as " *crocus Martis* " ; lead acetate is occasionally Latinized as " *saccharum Saturni* " ; and verdigris is sometimes known by the synonym of " crystals of Venus."

Geber's full name is variously given as Abou Moussah Djafaral Sofi or Jabir ibn Hayyan. He is said to have been born in Bokhara and had traveled extensively and had become a Mohammedan convert while he was in Bagdad studying medicine. Some of his knowledge may have been derived from the Orient, where the cult of Tao is said to have been associated with a search for the philosopher's stone and the elixir of life. He later became a teacher in Seville.

It was during Geber's period (702–765) that the art of papermaking was brought from Samarkand, and the decimal notation of the Arabs, acquired by them from a now forgotten race in India, was just beginning to be used in Europe. Geber is the first of the chemical authorities who describes in detail the operations of distillation, sublimation, and calcination. He is the reputed discoverer of sulphuric acid, " oil of vitriol " ; of nitric acid, " aqua fortis "; and of nitrohydrochloric acid, " aqua regia," as well as of corrosive sublimate and lunar caustic.

The titles of the treatises attributed to him are usually symbolic or figurative, as *The Book of Royalty, The Book of Balances, The Little Book of Pity, The Book of Concentration, The Sum of Perfection,* and *The Book of Oriental Mercury.* The language of most of Geber's works is so obscure and so replete with fine-spun metaphysical discussions as to account for the etymology of the word "gibberish." A short example will suffice.

> Establish the equilibrium, the parallel with the aid of fire of three degrees, namely the incipient fire, the medium fire, the extreme fire, which melts the elixir; the solid will melt like wax and afterward harden in the air. It will penetrate and be introduced like a poison. The result will conform to the operation if the substance is excellent. The operation will be only rapid with the preceding substance, it will be very solid and very pure. Only one part will suffice for a million.

And thus was launched by the semi-historical, semi-mythical character, who spoke in riddles and yet with seeming authority, a search for an *ignis fatuus*, which lured philosopher and king, pope and cardinal, physician and pharmacist, for nearly a thousand years, until Paracelsus diverted the efforts of the searchers into fields of work that removed the reproach from alchemy and made possible the development of chemistry, which emerged late in the eighteenth century as a science. The milestones along the trail of this long

search were the important discoveries of substances hitherto unknown. The landmarks on this same trail were the failures that made necessary a fresh start or which contributed by-products of unexpected value and entirely foreign to the quest itself.

Geber was the only Arabian who wrote upon chemistry exclusively. Let us now turn our attention to some of the Arabians who left their impress particularly upon pharmacy. In 772 Almansor, Caliph of Bagdad, brought from the famous Nestorian school at Nishapur a celebrated Christian physician and pharmacist known as George Bakischwah. He translated certain books from Greek and Latin medical authors into Arabic, after which he returned to Persia and left his son behind. The latter attained such eminence that he became physician to two succeeding Caliphs and received a salary of 10,000 drachmas yearly. This is equivalent to about $2000 in United States money of the present period, but the purchasing power of such a sum then was many fold what it is now.

After Geber, the next one in chronological order was Mesue Senior (777–857), sometimes known as *Janus Damascenus* or John the Damascene. He was the son of a pharmacist at Gundi Shapur, and became so eminent in medicine and

pharmacy that he was made head of the great medical school at Bagdad and physician to Caliph Haroun al-Raschid during the Golden Age of the Eastern Caliphate, although he was a Nestorian Christian. He is known through the Latin translations made from the Arabic after the beginning of the fifteenth century, and his pharmaceutical formulary served as a model for the first London Pharmacopœia. He was sometimes called Serapion the Elder or Serapion Senior.

Mesue was violently opposed to the drastic purgatives which had been employed by the Greeks and Romans. He is credited with the introduction into medicine of the mild laxatives: senna, cassia fistula, tamarinds, jujube, and others of a similar character. He was physician to five successive Caliphs.

He had two pupils who attained distinction. One of these, Hunayn ibn Ishaq, was better known as Johannitus, and he translated Galen's works into Arabic, from which Latin translations were made later. Johannitus headed a group of translators of medical works into Arabic and he had a son assisting him who made some independent translations, sometimes confused with his father's. Another pupil was the Christian scholar Isa ibn Ali, usually given as Jesu Haly.

A contemporary of Mesue and his pupils was

Al Kindi, known as Alkindus or Alkakendi. He was the only one of the medical and pharmaceutical authorities who was of pure Arab stock. He, too, was a physician to the Eastern Caliph of his period. He left many works to posterity, of which more than twenty were on pharmacy and medicine.

Probably the most eminent of the medical authorities of the Eastern Caliphate was Ar Rasi, commonly called Rhazes, and sometimes Albubator. He was born in Persia in 841, and at the age of thirty became head of the hospital at Bagdad. He is credited with having written nearly 250 works, some of which were upon pharmaceutical subjects, but the most important of which was an encyclopedia of medicine called the *Continens,* in which is found the earliest descriptions of smallpox and measles. Rhazes describes in detail the impositions and charlatanry of the irregular medical practitioners of his time.

Isaac Judæus, an Egyptian Jew, was a medical writer contemporary with Rhazes, but by no means equalling him. Garrison, in his *History of Medicine,* classes Rhazes with Hippocrates in his influence upon medicine.

Another medical writer who followed Rhazes in the Eastern Caliphate was Haly Abbas, who, like his illustrious predecessor, was a Persian.

FIG. 13.—TITLE-PAGE OF PARACELSUS' *Labyrinth of Medical Errors*, WITH PICTURE OF THE AUTHOR.
SEE PAGE 248.

We now come to the first great figure in the Western Caliphate. Albucasis of Bucasis or Alizaharavius, as he was variously known, was a Spaniard who became physician to Caliph Abd ar Rahman at Cordova. His works were mainly upon surgery, upon which he left an impression that lasted for centuries. His principal pharmaceutical work was *Liber Servitoris,* which described the medical preparations and properties of animals, plants, and minerals. He was born about 936 and died at the close of the tenth century.

No great figures appear again in the Western Caliphate for nearly 200 years, but the Eastern Caliphate, in the meantime, furnished some more notable pharmaceutical and medical authorities.

Mesue Junior is said to have been born in the middle of the tenth century at Marindi on the Euphrates, and to have studied at Bagdad, where he later attained eminence. His *Grabadin Medicinarum Particularum* was used as an apothecaries' manual for nearly 500 years, and it was through this work that much of Arabic pharmacy found its way into Europe, where it went through hundreds of editions. Some authorities call him "Pseudo-Mesue" and cast doubts upon his very existence, as no Arabic originals of his works have ever been found. If there was no such character as Mesue Junior, then some clever Latin compiler

must have assumed the name, and there is no doubt whatever of the esteem in which these works were held for centuries.

Another countryman of Rhazes, a Persian named Ibn Sina, anglicized as Avicenna, was one of the most eminent of physicians and philosophers of the tenth century. It is his likeness that adorns the diploma of the Pharmaceutical Society of Great Britain. He was born in the province of Bokhara in 937. He is said to have learned the Koran by heart at the age of ten years, to have been an accomplished physician and learned in philosophy and science at eighteen. At this time he performed a successful operation on the Caliph and was made Vizier and given many honors. At the age of twenty-one he wrote an encyclopedia of all sciences except mathematics.

He was what Garrison calls a "convivial Omaran spirit," and became involved in court intrigues which caused his imprisonment. He escaped from prison and for a long time lived in the house of a friendly apothecary, where he wrote most of his noted works during the enforced seclusion. As a result of fast living and overwork he died at an early age. His most famous book, written under the circumstances just related, was the *Canon,* an unwieldy and mis-

cellaneous collection of past medical lore with his interpretations thereof. It contains nearly a million words and is divided into five portions.

Avicenna is said to have founded the Græco-Arabic school of medicine and his works were considered authoritative and used in the universities of Europe as late as 1650. Inasmuch as his writings are in part as unintelligible as Geber's, it may be that the latter's obscurity was not due to concealment, but to the curious obsession of some of the ancient writers that sublimity and obscure metaphor were synonymous. At any rate, Avicenna had no reason to conceal his facts, as Geber is supposed to have had.

One bad influence which Avicenna's writings had was to discourage surgery by suggesting that it was beneath the dignity of physicians to practice this "manual art." He is the first authority to describe one of the parasitic infestations of the body (the guinea worm), and also the first to note the sweet taste of the urine of diabetic patients. He introduced the gilding and silvering of pills, not for the purpose of improving their appearance, but to enhance their therapeutic effect, and he distinguished between fixed and volatile alkalies.

Avicenna is also noted for his geological obser-

vations, and as he was famed as a poet, by some authorities he is believed to have written the quatrains attributed to Omar Khayyam, whom he preceded by about a century.

Coming back now to the Western Caliphate, we find Serapion Junior, Guefit, also called Abenguefit, and Baytar, who wrote upon pharmaceutical subjects in the eleventh century. The first great figure in the Western Caliphate after Albucasis, who has already been discussed, was Avenzoar, also sometimes known as Abhomeron. He was born in 1113 at Seville of an illustrious Spanish family, and was the son of a physician. He was opposed to mysticism and astrology and left several important works which influenced pharmacy and alchemy for several centuries. One of the noteworthy facts of his career was that he dared contradict some of the teachings of Galen. He died at an early age and was honored by his contemporaries by being called "The wise and illustrious."

Avenzoar placed great faith in bezoar stones and was the first medical authority to write of them. These are concretions, partly mineral, partly organic, found in the intestinal tract of herbivorous animals. The name is from the Persian and means "expeller of poisons." They were so highly esteemed in later periods in phar-

macy that they were included among the drugs officially described during the first century of the London Pharmacopœia. There were two varieties—one the Oriental bezoar, which was given in doses of from 4 to 16 grains, and the Occidental bezoar, which was weaker and given in doses of from 16 to 30 grains. They were also carried in gold or silver boxes as amulets, and sometimes during plague were rented at a large sum per day. One of the presents of an Eastern Nabob to Queen Elizabeth was a large-sized bezoar stone. The prices were sometimes almost incredible and an entire feudal estate was once given in exchange for a single specimen.

Avenzoar had a curious and mistaken idea of their origin, which was given as follows: "They come from the eyes of stags. The stags eat serpents to make them strong and at once run into streams and stand in water up to their necks to counteract any injurious effect of their serpentine diet. They do not drink any of the water, which would cause their immediate death. The standing in the stream attenuates the poison and then a liquor exudes from the stag's eyelids, which coagulates and forms a stone, which is the famous bezoar."

The next outstanding pharmaceutical authority in the West was Averrhoes or Averroes. He

was born at Cordova in 1126 and became a friend of Avenzoar, who doubtless had a great influence upon his career. Averroes was an Aristotelian freethinker, who raised doubts concerning the creeds of both the Mohammedans and Christians and was accordingly hated by both. His exceptional attainments led him to positions of prominence under the Caliphs of the West. He established a school of scientific thought which was perpetuated by the Jews after his death, and Jewish Averroism lasted until the fifteenth century. He was a follower of the teachings of Alkindus and opposed to Galenism, like his friend and contemporary Avenzoar. His most famous pharmaceutical work is the *Colliget*, which later appeared in many editions and translations.

The last character of note in the Arabian group was another contemporary of the two who have just been discussed. He was a Jew named Rabbi Moses Ben Maimon, but is better known to us as Maimonides. He was born at Cordova in 1135 and was a pupil of Averroes. At that time the tolerance of the Mohammedans of the Western Caliphate toward teachers belonging to other faiths had begun to be replaced by antagonism. Maimonides was given the alternative of embracing Mohammedanism or of leaving the kingdom.

FIG. 14.—ILLUSTRATION OF A SIXTEENTH CENTURY PHARMACY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 206.

He chose the latter course, went to northern Africa and completed his studies at Fez. From there he again had to flee, and this time went to Palestine and from thence to Egypt. He had come from a wealthy family, but after settling in Cairo he lost his fortune and took up medicine for a livelihood. At that time he was in his early twenties, but so rapid was his professional progress and so great his renown, that when he was twenty-five he was made private physician to Saladin, the Scourge of the Crusaders. While in that position he was given the supervision of the preparation of *theriaca* and *mithridatum* for the community. While engaged in this work he spared no trouble nor expense to import the rare ingredients of these famous preparations, and he became so much interested in the subject that he wrote a work on toxicology. This manual, which was one of the earliest of its kind, reflects the superstition of the age, for the author considers the most efficacious antidote for the bites of poisonous serpents to be the use of an emerald applied to the stomach or held in the mouth.

When Richard the Lion-Hearted of England was in Acre during the Crusades he offered Maimonides the position of personal physician if he would accompany him back to England, which Maimonides refused to do.

Maimonides translated the *Canon* of Avicenna into Hebrew and made collections of the aphorisms of Galen and Hippocrates, which he translated into the same language. He was more of a theorist than a general practitioner, although his personal magnetism and a certain native ability gave him a high reputation in the latter field. He is best known to us through his idealistic medical creed, which is commonly known as the Oath and Prayer of Maimonides, and is as follows:

THE OATH AND PRAYER OF MAIMONIDES

Thy Eternal Providence has appointed me to watch over the life and health of Thy creatures. May the love for my art actuate me at all times; may neither avarice, nor miserliness, nor the thirst for glory, nor for a great reputation engage my mind; for the enemies of Truth and Philanthropy could easily deceive me and make me forgetful of my lofty aim of doing good to Thy children.

May I never see in the patient anything but a fellow creature in pain.

Grant me strength, time, and opportunity always to correct what I have acquired, always to extend its domain; for knowledge is immense and the spirit of man can extend infinitely to enrich itself daily with new requirements. Today he can discover his errors of yesterday and tomorrow he may obtain a new light on what he thinks himself sure of today.

O God, Thou hast appointed me to watch over the life

and death of Thy creatures; here I am ready for my vocation.

And now I turn unto my calling:

O stand by me, my God, in this truly important task;
Grant me success! For——
Without Thy loving counsel and support,
Man can avail but naught.
Inspire me with true love for this my art
And for Thy creatures,
O, grant——
That neither greed for gain, nor thirst for fame, nor vain ambition,
May interfere with my activity.
For these I know are enemies of Truth and Love of men,
And might beguile one in profession
From furthering the welfare of Thy creatures.
O strengthen me.
Grant energy unto both body and the soul
That I might e'er unhindered ready be
To mitigate the woes,
Sustain and help
The rich and poor, the good and bad, enemy and friend.
O let me e'er behold in the afflicted and suffering,
Only the human being.

This fine conception of the duties and responsibilities of the physician is worthy of ranking with the Oath of Hippocrates and has been a great factor in the development of medical and pharmaceutical ethics.

In reviewing this Arabian period of the development of pharmacy one is impressed with the wealth of material that was accumulated and passed on to posterity with a curious blending of fact, fiction, and idealism. The Arabians contributed many new drugs and encouraged the use of some older ones which had almost been forgotten. We are indebted to them for the use of senna, camphor, rhubarb, musk, myrrh, cassia, tamarind, nutmeg, cloves, cubeb, aconite, ambergris, cannabis, and sandalwood. They were the originators of syrups, juleps, alcohol, and aromatic waters.

The Arabian pharmacists were called "*sandalini,*" and their stocks were regularly inspected and punishment meted to those who were found guilty of selling spurious and deteriorated drugs. The effect of Arabian chemistry and pharmacy was felt for hundreds of years and influenced and stimulated the production of many pharmacopœias of the Middle Ages. We can form some idea of their advancement in material things as well, when we realize that when most of Europe was sunk in the depths of barbarism or emerging from primitive conditions almost beyond belief, Moorish Spain had attained to a degree of development that easily accounted for her supremacy.

When London was without a single paved street or a street light, and when the inhabitants of Great Britain, for the most part, were living in windowless, chimneyless shelters, Cordova boasted of more than 300 mosques, 50 hospitals, a library of nearly 250,000 volumes, 200,000 houses, and many miles of paved and lighted streets. Other cities, such as Granada, Toledo, and Seville, were almost as high in their standards of living as Cordova. One of the first examples of an indoor, sanitary toilet was found in the Alhambra.

The Arabs were noted for their hospitals during this period also. One of them is described as follows:

> It possessed four courts, each having a fountain in the center; lecture halls, wards for isolating certain diseases, and dispensaries for out-patients were also found. Among the most novel attractions was a hall where musicians played day and night and another where story-tellers were employed for the benefit of those who suffered from insomnia. Those religiously inclined could listen to the reading of the Koran, which went on day and night uninterruptedly in certain rooms. Each patient, upon being discharged from the hospital as cured, received some gold pieces that he might not be obliged to attempt hard labor at once.

The Arabian idea of hospitals was probably derived by them from the ancient Hindus, who had

very elaborate rules and regulations for the conduct of such institutions and supported them by taxation. Hospitals are reported to have been in existence in pagan Ireland four centuries before the Christian Era.

Some of the Arabian authorities speak of a form of anesthesia by inhalation. This was probably derived from the Chinese, for Hua T'o, the Hippocrates of China, is said to have taught this practice and used for the purpose a combination of aconite, datura, and henbane. It was later revived in the thirteenth century, when it was called the "soporific sponge." And all this from a people who were so despised as to warrant a special clause in the litany of the English Church during the period of the Crusades, which read: "From the Turk and the Comet, good Lord, deliver us."

In concluding the consideration of this important period, concerning which so much has been written by medical and chemical historians, we come to a realization of the fact that the Arabian progress was largely due to authorities who were of other than the Mohammedan faith.

Bearing Arabic names, as they all do, it has not been generally realized that if we take away the work of Geber, Mesue, Rhazes, and Avicenna, who were, originally at least, Nestorian

Christians, of Albucasis and Avenzoar, who were Spaniards, and of Averroes and Maimonides, who were Jews, there is not much left with which the Arabians, or at least the Mohammedans, may be credited.

It is their tolerance, however, toward teachers of other faiths for which we must feel grateful —a tolerance which was never equalled by the early Christians or the Jews themselves.

CHAPTER IV

MEDIEVAL PHARMACY. THE ORIGIN OF UNIVERSITIES. THE INFLUENCE OF THE CRUSADES ON PHARMACY

When Peter the Hermit and Walter the Penniless organized the first crusade, toward the end of the eleventh century, they started ripples in the ocean of civilization that developed into the waves of the Renaissance nearly four centuries thereafter.

The influence of this movement was profound in its effect upon pharmacy, for it brought about a fusion of Arabian learning with the empiric practices based upon folk lore and tradition in central and northwestern Europe, and stimulated into activity certain cultural factors that had lain dormant for centuries.

To understand this period we must retrace our steps to a certain extent and learn what was going on in other parts of Europe while the Arabians were dominant along the Mediterranean.

The Dark Ages which followed the downfall of Rome were succeeded by a period in which the only sparks of intellectualism or of science were kept alive by the Benedictine monks, who scattered themselves all over Europe and established

monasteries. This famous holy order had been instituted at Monte Cassino, near Naples, in the fifth century A.D., as was stated in a previous chapter.

The importance of this movement is better understood when we realize that its origin was synchronous with the closing of the schools of Athens by Justinian. This period of monastic medicine would have made greater progress had it not been hampered by excessive confidence in healing by faith and in the power of saints and of holy relics.

In France medicine had degenerated into the employment of wonder-cures and temple-sleeps similar to those of Greece in the time prior to Hippocrates. The welter of Huns and Romans in southern Europe had brought into existence the Romance languages of our time, which are the result of a combination of the Latin and Teutonic tongues. Latin and Greek remained the repository of most of the learning of the world, and Greek was the spoken language throughout most of Italy until the thirteenth century. Islam, Christianity, and Israel were fighting for material as well as spiritual supremacy.

Under Charlemagne, who reigned contemporaneously with the Golden Age of Bagdad, conditions had somewhat improved. Under

Theodoric, King of the Ostrogoths, an edict had been issued to the effect that if a patient died from the results of an operation the physician should be handed over to the relatives of the deceased to do what they pleased with him. This discouraged the practice of surgery in northern Europe for several centuries. It would probably discourage it now if such a law were still in effect.

Under Charlemagne, medicine was taught under the name of *physicus,* hence the origin of our name physician for one who practices medicine. Charlemagne had in his *Capitulaires* prescribed a list of medicinal plants which were to be cultivated in gardens. From this modest beginning came the idea of botanical or plant gardens, which was to culminate hundreds of years later, when in the sixteenth century many of the famous botanical gardens of the world were instituted.

During this period of monkish medicine some of our plant and drug names came into use, such as rosemary (literally, the Rose of St. Mary), St. Johnswort, and others.

A great deal of pseudo-religious medical and pharmaceutical hocus-pocus originated about this time and left its influence for many centuries in pharmaceutical formularies and pharmacopœias. For instance, there was the "ointment of the twelve apostles" (see illustration No. 36, oppo-

FIG. 15. ILLUSTRATION OF A SIXTEENTH CENTURY PHARMACY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 204

site page 318), which had twelve important ingredients, and the practice of repeating a particular psalm or prayer while liniment was being rubbed in. This latter was not so much for the purpose of asking divine intercession on behalf of the patient as to regulate the time of the application.

The cultivation of medicinal herbs in the monastery gardens during the eighth and tenth centuries laid the foundations of the science of botany, although it did not contribute much of value to the vegetable materia medica, because of the blind faith which was reposed in simples, irrespective of their demonstrable effects. About the same time the word "drug" appears in literature. It is of Teutonic origin, and simply meant a "dry herb" in its original significance. The word "druggist," applied to sellers of drugs, did not appear in common use until about the sixteenth century.

The monasteries and convents also possessed collections of minerals and animals as well as plants, and the members of the religious orders treated not only sufferers of their own faith, but gave assistance to all who implored their aid. The treatment of non-surgical cases usually consisted of good food, quiet and rest, and the administration of decoctions of simples from the gardens.

In this way, by treating bodies as well as souls, the members of the monastic orders disseminated much knowledge concerning healing.

The monastery gardens were a factor also in the development of herbals, or books of plant lore, which appeared, frequently of folio size and profusely illustrated, in the sixteenth and seventeenth centuries. The oldest of these appeared about 500 years before the introduction of printing. It is an illustrated manuscript called the *Herbarum Apuleii Platonici,* and is known in a Saxon edition of the tenth century. It purports to be a Latin translation of a fifth century work which has never been discovered.

Three other famous works on drugs also appeared in the tenth century in manuscript form. One of these, called the *Hortulus,* is not so noted as the other two, which are known respectively as the *Leech Book of Bald* and the *Lacnunga.* The former is of Saxon origin. The recipes are interesting, even if not very convincing as to their efficacy. They are combinations of charms, spells, and herb doctoring, such as have always been prevalent among simple and uneducated peoples. Here are a few examples:

> For headache take a vessel full of leaves of green rue, and a spoonful of mustard seed, rub together, add the white of an egg, a spoonful, that the salve may be thick. Smear with a feather on the side that is not sore.

This does not inspire one with confidence.

Still another shows the superstitious trend of the times:

> Against dysentery, a bramble of which both ends are in the earth, take the nether root, delve it up, cut nine chips with the left hand and sing three times the Miserere Mei Deus and nine times the Pater Noster; then take mugwort and everlasting, boil these worts and the chips in milk until they get red, then let the man sip at night fasting a pound dish full, let him rest himself soft and wrap himself warm; if more need be let him do so again; if thou still need do it a third time thou wilt not need oftener.

The *Lacnunga* was a similar work to the *Leech Book of Bald* in its general plan and composition, but its literary style is quite modern in that it is altogether in what would pass for excellent "vers libre." The following example is an illustration. It is a description of the common herb known as Achillea or yarrow, once greatly extolled as the herb with which Achilles anointed his spear so that it would heal the wounds it made.

> "Eldest of worts,
> Thou hast might for three,
> And against thirty
> For venom availest,
> For flying things,
> Mighty against loathed ones
> That through the land rove."

The Druids of Wales and the wandering Celtic monks from Ireland and Scotland, who traveled extensively through Europe in the centuries preceding the Crusades, left an interesting legacy of medical lore concerning both plant and animal products. Manuscripts in the Gaelic language have been found containing about the same sort of material as in the works from which quotations have been given. Several unusual Celtic remedies for baldness read as follows:

> Let calcine a raven, his ashes boil in sheep's suet, and rub to the head, it cures.
>
> With mice fill an earthen pipkin, stop the mouth with a lump of clay, and bury it beside a fire, but so as the fire's too great heat reach it not. So let it be then for a year, and at the year's end take out whatever may be found therein. But it is urgent that he who shall lift it have a glove on his hand, lest at his fingers' end the hair come sprouting forth.

Page the S.P.C.A.!—The advertising claims of modern hair restorers seem modest compared with this.

It is probable that these leech books were the survival of Druidic rites and customs. The Druids of Wales were sorcerers and magicians, who used augury (inspection of sacrificial entrails) for prognosis and herbs for therapeutic treatment. Mistletoe (*viscum album*) was their great pan-

acea. Lycopodium, pulsatilla, clover, primrose, henbane, and verbena were also most highly esteemed as remedies, although they used wormwood, betony, bryonia, centaury, belladonna, hellebore, and mandragora. Women Druids, or Druidesses, were especially gifted in second-sight.

About the same time as the appearance of these leech books, a letter was sent by Helias, Patriarch of Jerusalem, to Alfred the Great of England. Alfred will be remembered from the fact that his reputation as a king was better than his reputation as a baker of cakes. This letter is principally concerned with medicines in Syria at the time. The communication appears to be a reply to an inquiry from Alfred. Helias mentions scammony, ammoniac, tragacanth, aloes, galbanum, balsam, petroleum, alabaster, and theriac. Helias must have had great faith in the last remedy, concerning which his directions are very explicit, except as to the dosage, as the following quotation will show:

Theriaca is a good drink for all inward tenderness, and the man who so behaves himself as is here said, he may much keep himself. On the day on which he shall drink Triacle he shall fast until midday and not let wind blow on him that day; then let him go to the bath, let him sit there until he sweat; then let him take a cup, put a little warm water in it, then let him take a little bit of the Triacle

and mingle it with the water, and drain through some thin raiment, then drink it, and let him go to his bed and wrap himself up warm, and so lie until he sweat well; then let him arise and sit up and clothe himself, and then take his meat at noon, and protect himself against the wind that day; then I believe to God it will help the man much.

One of the formulas of the *Leech Book of Bald* is the prototype of our " blue ointment," as will be appreciated by the following:

Against lice, one pennyweight of quicksilver and two of old butter.

In the tenth century, Pope Sylvester II studied Arabian mathematics and the translation of many Arabian works into Latin was begun. His name, before being elevated to the papacy, was Gerbert. He had traveled extensively and spoke Arabic and Greek and wrote Hebrew fluently. It was he who introduced into Europe what we now call the Arabic system of numbering, which the Arabs themselves had brought from the Far East, and which quickly displaced the cumbersome Roman system of writing numbers and calculating. Gerbert has been acclaimed as " the first mind of his time, its greatest teacher, its most eager learner and most universal scholar." In these respects he is in strong contradistinction to the popes of several centuries later, for they

punished all the possessors of learning and forbade their books to be read.

The schools of Salerno, Toledo, Seville, and Cordova were founded some time prior to the Crusades, and exerted influence upon the development of all science and especially of medicine and pharmacy.

In the middle of the tenth century the European foothold which the Arabs had succeeded in gaining in Spain was at its maximum. Cordova was at that time the western center of Arabian learning, industry, and commerce. According to Dr. Donald Campbell, the historian of Arabian medicine, the Jews were the leading lights of the medical fraternity of Spain from the ninth to the eleventh centuries and were greatly esteemed as physicians in Latin Europe. The fact that the Crusades were directed only against the Moslems of the East afforded the Jews in Spain an opportunity which was quickly grasped.

From the ninth century Cordova had attracted the scholars of Christendom who sought the "Saracenic studies." Cordova was referred to as the "center of religion," "the mother of philosophers," and the "light of Andalusia." There was a separate Jewish academy at Cordova in the tenth century, and its influence rapidly spread throughout Europe. One of the most famous

Italian Jews of this period was Sabbatai Ben Abraham, better known as Donnolo.

Donnolo had traveled extensively in the Orient and is said to have studied the sciences in Greece, Babylonia, and even as far away as India, besides absorbing what the Arabs had to offer. He wrote several famous works on medical and pharmaceutical subjects. His *Antidotarium* is the second oldest work of its kind in Hebrew, the oldest being a book of remedies by Asaf Judæus, a Babylonian physician of the seventh century.

The *Antidotarium* of Donnolo contains detailed descriptions of many drugs and remedies.

One of the great Latin translators of the eleventh century was Constantinus Africanus (Constantine the African). Although he had only a minor contact with Salerno early in his career, he had a great influence upon Salernian literature. He was a native of Carthage, and for a time was a slave. Like Donnolo, he had traveled extensively in the Orient and familiarized himself with the scientific learning of many countries. Being suspected of sorcery, he was compelled to flee his native land. He made his way to Europe and became attached to the staff of Robert the Norman, ruler of the two Sicilies, and made his headquarters at Salerno. He soon tired of court

Fig. 16.—Illustration of a sixteenth century pharmaceutical laboratory. From Peters' *Pictorial History of Ancient Pharmacy and Medicine.* See page 205.

life and retired to the cloisters of Monte Cassino, where he devoted his life to the translation of the learning of the previous centuries into Latin. He was called "*Orientes et Occidentis Doctor.*"

His principal works were upon medicine, although he wrote an *Antidotarium* and a *Glossary of Herbs and Drugs.* He is said to have been the first Latinizer of Arabic culture, and through his writings there was awakened an interest in Arabic materia medica and pharmacy which caused the revival of the study of such early manuscripts of Hippocrates and Galen as had escaped destruction up to that time.

A Saracen pupil of Constantine named Johannus Afflatus followed in his footsteps and became the author of an encyclopedia of medicine which was long used as a text-book of internal medicine.

In Great Britain, in 1042, the progress of medicine was clouded by the institution of the "royal touch" under Edward the Confessor. The royal touch was the sovereign treatment for scrofula or King's Evil. The treatment consisted in the laying on of hands by royalty or the use of a "touchpiece" to which the King had transmitted his power. In later periods the practice was accompanied by an elaborate ritual, and it was not abandoned in England until the eigh-

teenth century, when the House of Hanover thrust it into the discard.

In 1055 A.D. there was a revival of the arts in Europe generally. In 1070 A.D. London Bridge and Westminster Abbey were begun. Norman French was at this time the legal language in Great Britain and the only language taught in the schools apart from the classic Latin and Greek tongues used by scholars.

The possession of learning conferred privileges which later were crystallized under the title " Benefit of Clergy," in which one who could prove himself proficient in reading and writing was immune from punishment for all but major crimes.

Norman Duke Robert took Salerno in 1076 and for a time its university was the leading educational center of Christendom. In 1095, the First Crusade began and Salerno acquired additional importance because it was the location of the base hospital for the militant Christians. The schools of Salerno, of Seville, of Toledo, and of Cordova in their early days were hardly to be called universities in the later meaning of this term, although Salerno developed into a true university type of school under Robert of Sicily. The word " university " means " an association," and the principal universities of Europe had their

origin in the voluntary association of guilds of students banded together for mutual protection and established at some place favorable to the pursuit of their studies.

Four degrees were conferred in most of these institutions, of which the lowest was the licentiate, next the baccalaureate or bachelor's degree, the third the master, and the highest the doctorate, which latter required from six to eight years of study.

Several types of universities were developed as the desire for learning grew. Of course, there were those which were under ecclesiastical authority and those which were under State or other control. The University of Bologna was one of a type in which the control was entirely in the hands of the students themselves. They engaged the lecturers and appointed the teachers.

Salerno was the first of the educational institutions of the true university type, dating from about the eighth century. Of the other important early universities that of Paris was founded in 1110, Bologna in 1113, Oxford in 1167, Cambridge in 1209, Padua in 1222, and Naples in 1224. All of these but Salerno are still in existence, Salerno having been abolished in 1811 by a decree of Napoleon. Pharmacy was taught in all

of these institutions as a part of the course in medicine.

In 1150 the Sultan Kalid of Egypt is said to have gathered many alchemists at his court and to have made experiments upon transmutation, and to have compiled a number of treatises upon hermetic subjects.

One of the most eminent pharmaceutical authorities of this period was Nicholas Præpositus or Nicholas Salernitatus (Nicholas of Salerno). Nicholas was director of the medical school at Salerno. His most famous work was an antidotarium. This work was the standard for pharmaceutical preparations for centuries. In this antidotarium is found the fundamental basis of our present apothecaries' weights, *i.e.*, the grain, scruple, and drachm, just as we now have them. Nicholas perpetuated in his antidotary some of the pseudo-religious formulas of preparations supposed to have been originated by the Apostle Paul and others.

Nicholas was an encourager of polypharmacy. His *Confectio Adrianum* contained thirty-eight ingredients, *Confectio Atanasia* thirty-five, and *Confectio Esdra* forty-eight. Of the sacerdotal formulas there were the *Confectio Evangelon*, *Emplastrum Apostolicum*, and the *Potio Sancti*

Pauli, the latter preparation being used for epilepsy. Nicholas also had a chapter of official substitutes, under the heading "*Quid pro quo.*" His antidotarium was sometimes known as *Antidotarium Parvum*, to distinguish it from the *Antidotarium Magnum*, compiled several centuries later by another Nicholas, who came from Alexandria, and who will be referred to later under his name of Nicholas Myrepsus.

Schelenz states unequivocally that the "Antidotary of Nicholas Præpositus" formed the real foundation for the later pharmacopœias.

In Salerno at this time the study of anatomy was resumed under a decree which permitted the complete dissection of a human body every five years. Even that was better than is permitted now in the State of New Jersey, U. S. A., for no dissections whatever are permitted and consequently there are no medical schools in that State.

Didactic instruction in medicine and pharmacy at Salerno was founded on the works of Hippocrates, Galen, Isaac Judæus, Avicenna, and Nicholas Præpositus. A famous medical work which emanated from the school was the *Regimen Sanitatis*, also known as the *Flos Medicinæ.* This was used in clinical instruction. It was arranged in verse form to facilitate memo-

rization, as had been done by the Greeks and Romans a thousand years previously. Even the weights and measures were given in metrical cadence to enable the pharmacist to better memorize them. There were at first only a few hundred verses, but as time went on commentators and teachers added to the number until it finally reached over 2000.

There were famous women physicians at that early time, among whom were Trotula of Salerno, who first used mercury in the treatment of syphilis, and Constantia Calenda of Naples.

In the teachings of the school at Salerno were revived the " surgical sleeping draughts " mentioned by the Church fathers Hilary and Origen, and previously referred to under the name of the " soporific sponge." One of these was composed of opium, henbane, mulberry juice, lettuce, hemlock, mandragora, and ivy. This was inhaled from a sponge by the patient, who was later revived by fennel juice applied to the nostrils. This formula is given in the antidotary of Nicholas Præpositus.

One of the interesting characters of the early part of the twelfth century was the Abbess Hildegarde of the Benedictine Convent of Rupertsberg near Bingen. She is the reputed author of an important work on pharmacy and medicine which

took the form of an indigenous materia medica. It reeks with mysticism and superstition. It consists of nine parts dealing specifically with plants, elements, trees, stones, fishes, birds, animals, reptiles, and metals.

In the twelfth century there were factors which influenced medicine and pharmacy in diametrically opposite directions. The Papal edicts, which appeared first in 1130 and at intervals thereafter for several centuries, forbade the practice of medicine by the clergy or members of religious orders. This had a tendency to drive medicine and surgery into the hands of charlatans and mountebanks. There were those also who accepted Galen's dictum, later emphasized by the teachings of Avicenna, to the effect that surgery was an inferior branch of medicine. This had the result of making the surgeon a lackey and a subordinate and led to the consolidation of tonsorial and surgical work in the group of barber-surgeons, thus classified for centuries; in fact, in France an edict of Tours in 1163 specifically restricted surgery to barbers and mountebanks.

While the foregoing conditions obtained throughout Europe generally, a ray of hope appeared in the south of Italy, where the Norman brothers, Robert and Roger, had founded the Christian Kingdom of Sicily. In his realm and

by his authority Roger had enacted in 1140 a statute providing that every one who desired to practice medicine, which at that time practically included pharmacy, must present himself for examination before a magistrate and obtain a license, under pain of imprisonment and confiscation of property. This example was followed by other rulers of Christendom and the movement was a factor in the development of the study of medicine and the granting of special medical degrees.

In 1178 the charter of the Church of Cahöurs, France, mentions *apothecarii* among other classes of citizens. It is not certain that by this term was meant a seller of drugs or a pharmacist, for the word *boutiquier*, which means merely a shopkeeper in France today, is derived from the same source. The term "apothecary" came into use soon thereafter, however, as applied to pharmacists, and in 1180 the Guild of Pepperers in London included dealers in drugs.

The most noteworthy landmark in the classification of pharmacists and the development of pharmacy laws is the edict of Frederic II of Sicily, the grandson of Roger, in 1224. This edict regulated both the practice of medicine and the practice of pharmacy specifically. It refers to *apotheca* in the sense of a warehouse where

drugs and medicines were stored. The old Roman term *confectionarius* was revived and applied to the compounder of medicines and the term *stationarius* was applied to the seller or dispenser of drugs. The members of both of these groups were required to be examined and licensed by the medical school at Salerno. The examination was based upon the works of Hippocrates, Galen, and Avicenna, and a knowledge of the *Antidotary* of Nicholas. The *confectionarii* were required to swear that they would prepare all medicines according to the Salernian antidotary, probably that of Nicholas Præpositus previously described.

The prices to be charged for medicines were regulated and physicians were forbidden to share in the profits of prescriptions by clandestine arrangement with the *confectionarii.* The number of drug-dispensing establishments was limited and regulated and the compounding of certain electuaries had to be performed in the presence of inspectors who were selected from the best qualified pharmacists of the community. If any attempt to defraud was observed, or any flagrant violation of the law, the property of the offender was subject to confiscation. If an inspector was found to connive at a violation of the law, his punishment was death.

The sale of poisons, magical potions, and aphrodisiacal philtres was punishable by death if any person lost his life thereby. A few severe penalties might awaken a respect for pharmacy in the minds of some of the pseudo-pharmacists who infest the calling today. The effect of this edict, according to Beckmann, the German historian, was that the Salernian plan was followed pretty much throughout Europe. He further says:

Particular places for vending medicines were more necessary in other countries than in Italy. The physicians of that period used no other drugs than those recommended by the ancients; and as these had to be procured from the Levant, Greece, Arabia, and India, it was necessary to send thither for them. Besides, herbs, to be confided in, could only be gathered when the sun and planets were in certain constellations, and certificates of their being so were necessary to give them reputation. All this was impossible without a distinct employment, and it was found convenient to suffer dealers in drugs gradually to acquire monopolies. The preparation of medicines was becoming more difficult and expensive. The invention of distillation, sublimation, and other chemical processes necessitated laboratories, furnaces, and costly apparatus; so that it was thought proper that those who devoted themselves to pharmacy should be indemnified by an exclusive trade; and monopolists could be kept under closer inspection, so that the danger of their selling improper drugs or poisons was lessened or entirely removed. They were also allowed to deal in sweetmeats and confectionery, which were then great

luxuries; and in some places they were required to give presents of these delicacies to the magistrates on certain festivals.

There are some curious and interesting statements in the Salernian treatises of that period regarding the attitude of the physician toward his patient.

When entertained by the family, his remarks at the table are to be punctuated by continued inquiries regarding the patient, whose condition he should always regard as grave in order that either a favorable or a fatal termination of the illness might redound to his credit. He should not impair his professional standing by flirting with his patient's wife, his daughter, or his maid servants.

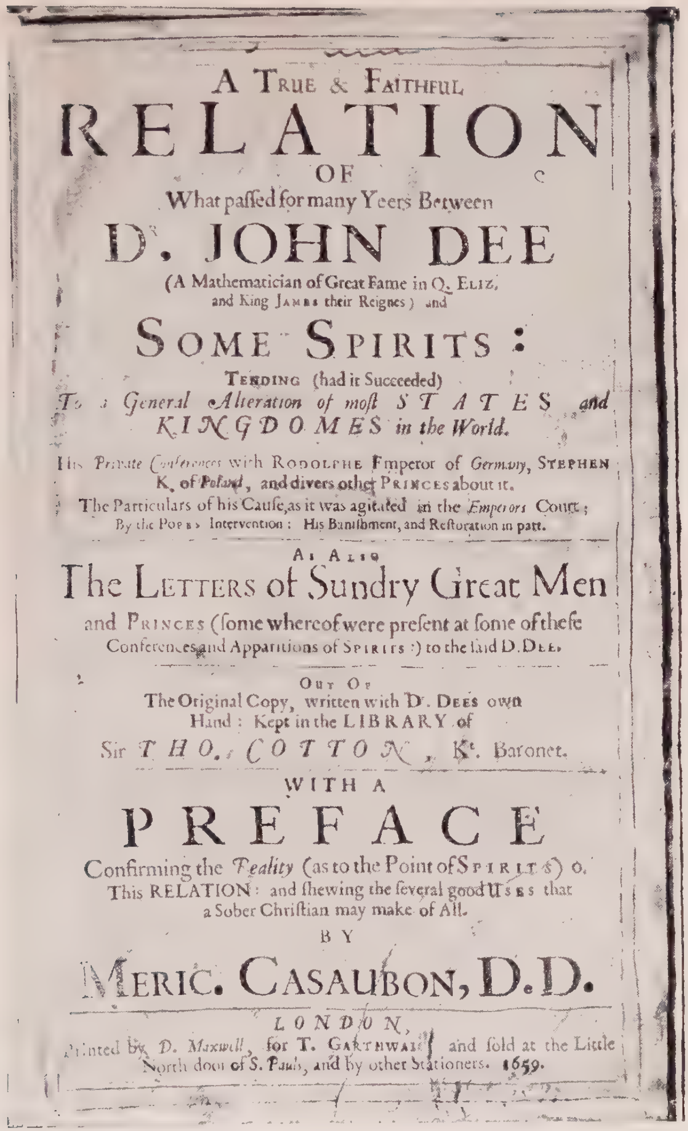
Illusory treatment by placebo was permissible in order that the patient might feel that he was getting his money's worth. One later authority added the advice that if a patient show signs of ingratitude in the matter of payment, he might be made temporarily ill by judicious dosing with certain drugs.

During the latter portion of this period concerning which we have been writing, the Venetian Republic was developing the strength and power that gave it the commercial supremacy of the following three centuries in the control of Oriental drugs and spices. The records of the customhouse of the port of Acre in Italy in the the early

part of the thirteenth century showed a large traffic in aloes, benzoin, camphor, cinnamon, cloves, cubebs, ginger, mace, musk, nard, nutmeg, opium, pepper, and rhubarb, according to Professor Tschirsch.

The Venetians brought the first sugar to Europe during the period of the Crusades, at which time it was so costly that it was used exclusively as a medicine, as were also most of the spices.

The period just completed is one of great importance. The awakened interest in learning and the dissemination thereof had ousted the leech books and replaced them by the "*antidotarii*" or formularies of greater value and authority. It was the embryonic period of the pharmacopœias which were born several centuries later. It was also the period in which pharmacy and medicine were first separated by legal enactments.



A TRUE & FAITHFUL
RELATION
OF
What passed for many Yeers Between
D^r. JOHN DEE
(A Mathematician of Great Fame in Q. ELIZ.
and King JAMES their Reignes) and
SOME SPIRITS:
TENDING (had it Succeeded)
To a General Alteration of most STATES and KINGDOMES in the World.
His *Private Conferences* with RODOLPHE Emperor of *Germany*, STEPHEN
K. of *Poland*, and divers other PRINCES about it.
The Particulars of his Cause, as it was agitated in the *Emperors* Court;
By the POPES Intervention: His Banishment, and Restoration in part.

AS ALSO
The LETTERS of Sundry Great Men
and PRINCES (some whereof were present at some of these
Conferences and Apparitions of SPIRITS:) to the said D. DEE.

OUT OF
The Original Copy, written with D^r. DEES own
Hand: Kept in the LIBRARY of
Sir *THO. COTTON*, K^t. Baronet.

WITH A
PREFACE
Confirming the *Reality* (as to the Point of SPIRITS) of
This RELATION: and shewing the several good USES that
a Sober Christian may make of All.
BY
MERIC. CASAUBON, D.D.

LONDON,
Printed by *D. Maxwell*, for T. GARTHWAIT, and sold at the Little
North door of S. *Pauls*, and by other Stationers. 1659.

FIG. 17.—TITLE-PAGE OF ONE OF THE MYSTICAL WORKS OF JOHN DEE. SEE PAGE 254.

CHAPTER V

MEDIEVAL PHARMACY AND ALCHEMY FROM THE TIME OF ROGER BACON TO THE FIFTEENTH CENTURY

We are now coming to the time when pharmacy emerges more generally as a distinct and separate calling. There is quite a difference of opinion among historians as to whether the Crusades really influenced the progress of the sciences. There is no doubt whatever that the bringing together of many men from many lands, all engaged in a common purpose, had a tendency to diffuse such knowledge as these men had acquired, for while the losses were great, large numbers of the Crusaders returned in safety, and may be expected to have carried with them something of value in the way of learning from the lands they had traversed.

Whether or not the evidence is apparent as to the effect of the Crusades, we must admit that the thirteenth century is notable for the great intellectual awakening which occurred simultaneously throughout Europe. The synchronism of these events cannot be overlooked. It is the century that gave to the world Dante, Boccaccio,

and Petrarch. In this century, too, auricular confession was introduced into the Catholic Church, and the Inquisition was established.

Dante had a contact with pharmacy which is not generally recognized. He was a member of the Guild of Apothecaries in Florence, for some unknown reason, for he was not an apothecary. His medallion is with those of illustrious pharmacists around the court of honor in the *École de Pharmacie*, Paris.

The most important event during the entire century, as affecting world history in general, was the signing of the Magna Charta at Runnymede by King John in 1215, the same year in which Genghis Khan, the Mongol conqueror, took possession of northern China. It was in the next century that Timur the Great, better known as Tamerlane, conquered Persia and almost all of the rest of western Asia.

The establishment of the universities mentioned in the previous chapter was followed in the thirteenth century by numerous others, including Salamanca, Sorbonne, and Lisbon. In 1335 Cordova, Seville, and Cadiz were wrested from the Arabs by Ferdinand III of Spain. The Moslems fell back to Granada and built the Alhambra, one of the most noted architectural concepts of any age.

Bagdad was conquered by the Persians in 1258 and for a time the spread of Islam was checked. The Spanish Moors are said to have spread throughout Europe, practicing pharmacy under the veil or cloak of Christianity, and made such a reputation for their pharmaceutic skill that the title "*Apotheken zum Mohr*" persisted as a mark of distinction in Germany for several centuries. The expulsion of the Moors from Spain led scholars to seek the former Spanish strongholds of the Moors in search of manuscripts, and Toledo became the translating center for many years, during which time numbers of Arabic works were translated into Latin.

Gerard of Cremona came to be designated as the Father of Translators from his activity in this direction, and it is to him that we are indebted for the Latin versions of the pharmaceutical works of Rhazes, Serapion, Isaac Judæus, Albucasis, and Avicenna. There were a few independent pharmaceutical writers or compilers also during the early part of the thirteenth century. The compendium of medicine of Gilbertus Anglicanus was more of a pharmaceutical than a medical work. He is the earliest author to describe minutely the method of "extinguishing" mercury to make "blue ointment." He gives details of the method of preparing a solution of potassium

carbonate, which at that time was known under the title of "*oleum tartari per deliquum.*" He anticipated Minderer by several hundred years in proposing a solution of ammonium acetate for use in medicine. He gave a prescription for apoplexy for which the pharmacist had to procure ants' eggs, oil of scorpions, and lions' flesh. A zoölogical garden would seem to have been indispensable as an adjunct to the pharmacy of that period. For calculi he employed the blood of a goat which had been fed upon diuretic herbs. This is a little in advance of our modern biologicals, but we may come to it yet.

In 1210 a guild of surgeons was instituted at Paris in which the members were divided into two classes. The "surgeons of the long robe" were the clerical barber-surgeons, who possessed some educational attainments. The "barbers of the short robe" were the lay barbers or surgeons. The word barber comes from *barbatonsorium,* or beard cutter. The lay barbers were later restricted to bloodletting and the treatment of ordinary wounds. The red and white spiral decorations on the modern barber's pole are emblematic of the blood and the bandages for which the barber shop was noted in the days of venesection. The blood in a modern "bobber" shop is accidentally shed.

About this same period the study of Aristotle was forbidden for a time, first by the authorities in Paris and later throughout Europe by the Pope in 1215. Aristotle's works did not remain long under the ban, for within a half-century they had regained favor and for several centuries were regarded as infallible. It seems strange to us that, in spite of their evident absurdities, the works of Aristotle, Pliny, and Galen should have maintained an authoritative status which few dared to question for many centuries.

Another famous pharmaceutical work appeared in the thirteenth century. This was an antidotary compiled by another Nicholas. He was called Nicholas Alexandrinus from the fact that he came from Alexandria, but he is better known as Nicholas Myrepsus, from *myrepsus*, an ointment maker, which was probably his early occupation. To distinguish his antidotary from that of his Salernian predecessor, it was called *Antidotarium Magnum.*

Nicholas Myrepsus practiced medicine for a time in Constantinople and also in Nicea. His work was the largest strictly pharmaceutical work that had yet appeared, and the broadest in its scope. He drew his material from all sources, Greek, Roman, Arabian, Christian, and Jewish. It is said to have contained over 2500 formulas,

which makes it larger in this respect than any modern pharmacopœia. He originally called it the *Dynameron.*

Its strictly pharmaceutical significance is indicated by the statement on the title-page, which declares that "It is useful as well for the medical profession and the *seplasarii.*" It was originally written in Greek. A Latin printed translation was issued by Fuchs of Nuremberg in 1658, nearly 400 years after its original appearance.

Myrepsus also gave space to the formulas of supposedly religious origin. One of these was for a preparation called the "Salt of the Holy Apostles," which, when taken morning and evening with meals, would preserve the sight, prevent the hair from falling out, relieve difficulty of breathing, and keep the breath sweet. This is the first recorded remedy for halitosis. It consisted of a mixture of aromatic herbs ground up with common salt. A similar but still more complicated preparation was the "Salt of St. Luke." Salts seemed to be favored in this formulary.

There was one called *sal purgatorius,* which had been prepared especially for Pope Nicholas. Another interesting formula in this antidotary is for a preparation under the title *antidotus acharistos,* which, literally translated, means "the antidote for which no thanks are given." This

title seems to have been bestowed because it cured sufferers so quickly that they did not appreciate how bad they might have been without it and were not sufficiently grateful to the giver.

Several formulas were given which were reputed to have come down from ancient Jewish lore. One of these was for an electuary which is said to have been prescribed for King David's spells of melancholy. It was composed of aloes and myrrh, with saffron, opium, and spices, made into a mass with honey—a sort of soporific "after-dinner pill," to drive dull care and other things out of the system.

A *sal sacerdotale,* said to have been used by Elijah, also appears, and this formula is reported to have come down through St. Paul.

One of the factors in the dissemination of knowledge concerning medicine and pharmacy during the thirteenth and fourteenth centuries, which is rarely taken into account, is the prevalence of epidemic disease at this particular period of the world's history. Leprosy, ergotism (called St. Anthony's Fire), and Black Death (Oriental plague) were the most important of these. Syphilis was another scourge which appeared about a century later. The prevalence of leprosy in Europe may be appreciated from the fact that there were more than 200 lazar houses in Great

Britain at that time and over 2000 in France. As one historian states:

> These living corpses wandered to and fro, muffled from head to foot; a hood drawn over the face, and carrying in the hand a bell, the Lazarus bell, as it was called, through which they were to give timely warning of their approach, so that everyone could get out of the way in time.

Ergotism was due to the eating of bread made from improperly cleaned rye. It produced gangrenous symptoms, followed by the dropping off of the affected members or limbs.

The "Black Death" caused the unprecedented mortality of 25 per cent. of the human race in the thirteenth and fourteenth centuries (about 60 million persons are said to have succumbed to it).

Leprosy received scarcely any treatment at all. Ergotism was frequently treated by charms or amulets, for its cause was not then understood. The Plague was treated as follows, according to John of Burgundy, who is better known to fame as Sir John Mandeville the traveler:

> Plague is held to be the effect of miasms or corrupt vapors upon the humoral complexion of the patient, the pestilence entering as an evil emanation through the pores of the skin and traveling thence to the heart, the liver, and the brain. To combat this, bathing was interdicted, lest the pores of the skin be opened, light diet, acid fruits and drinks, and especially liberal potations of vinegar were

FIG. 18.—FRONTISPIECE OF ONE OF THE MYSTICAL WORKS OF JOHN DEE. SEE PAGE 254.

recommended. The air of rooms was purified by burning juniper branches or throwing powders on live coals for the patients' inhalation. Aromatic drugs were exhibited internally and carried in the hand mixed with resin or amber, and if the disease was acquired, bloodletting was immediately resorted to. Vinegar acquired a prominent status as a preventive.

During the thirteenth century also Faculties were established by Papal bull to grant degrees in medicine at Montpellier, Salerno, and Paris.

In 1271 the Faculty of Medicine of Paris forbade herborists and apothecaries to practice medicine, but nothing is said concerning physicians who chose to practice pharmacy.

There were four outstanding figures in the thirteenth century. These were Roger Bacon, Albertus Magnus, Raymond Lully, and Arnold of Villanova.

Roger Bacon did not have as close contacts with pharmacy as had the others, but he stands out as the first really great character in general science for more than thirty generations. He was born in 1210 and died in 1292. He was an English Franciscan monk, and has been aptly described as a modern scientist living centuries before methods of modern scientific thinking were known. His master production was called *Opus Majus*, and it was an encyclopedia of all scientific knowledge up to and including his time. He

later wrote the *Opus Minus* and the *Opus Tertius.* He was a philosopher, mathematician, philologist, astronomer, physicist, microscopist, physical geographer, chemist, and physician, and certainly earned the title "*Doctor Mirabilis,*" later applied to him. He was the Sir Oliver Lodge of his time, for we are informed that he was interested in spiritual séances and in magic. In his *Radix Mundi* he is quoted as saying:

> Alchymie is the art or science of teaching how to make or generate a certain kind of medicine which is called the elixir. It teaches how to transmute all kinds of metals one with the other, and this by a proper medicine.

Bacon's difference from his predecessors and his acknowledged superiority as a leader of thought depend upon his independence of tradition and his championship of unrestricted inquiry. For this independence he was made to suffer by the Church by being several times imprisoned and his books being placed upon the *Index Librorum Prohibitorum.*

Roger Bacon proposed the reformation of the calendar, improved the theory of lenses, experimented with spectacles, telescopes, and microscopes, was familiar with gunpowder, for which he gave us one of the earliest formulas on record. He wrote of gunpowder in about 1270; it was first used in warfare at the battle of Crécy in

1346. He wrote of the possibilities of inventing and using diving bells, motor-propelled vehicles, and marine vessels and airships.

Bacon had traveled in Mediterranean Europe and had studied under Herman the German, one of the galaxy of Toledo translators, and also under the Arabist and highly scholastic Robert Grossteste, Bishop of Lincoln. He was strongly influenced by the teachings of Averrhoes, although he drew inspiration and material from Avicenna, Rhazes, Isaac Judæus, and Janus Domesticus. He quotes from an undiscovered work of Avicenna called *Philosophia Orientales,* in which a distinction is made between *al-kymia,* which is the art of transmutation, and *al-iksir,* which is the medium through which transmutation is effected. He had a knowledge of Greek, Aramaic, Latin, and of Hebrew, but could not read Arabic.

In a treatise of Bacon's which was read by Columbus, he quoted the views of Aristotle regarding the possibility of another continent across the Atlantic, and in that manner may be said to have influenced the discovery of America. His writings also influenced Copernicus.

Bacon's later works were written in cipher, probably to evade ecclesiastical jurisdiction, and

these works recently engaged the attention of the late Doctor Newbold of Philadelphia.

According to Doctor Newbold, who has partly translated the treasured scroll known as the "Voynich Roger Bacon Cipher Manuscript," he illustrated his work with what he saw through his optical instruments, and the translator asserts that Bacon was familiar with micro-organisms, with the cellular structure of plants, with the satellites of the planets, and with the spiral nebula in Andromeda.

Bacon's reasons for reverting to cipher for writing about his discoveries and observations may be explained also in the light of the following quotation from one of his works:

> One should not cast pearls before swine, for whosoever reveals mysteries derogates from the majesty of the universe, and those things which the mob is permitted to share do not remain secrets.

Bacon was referred to by Humboldt as the "greatest apparition of the Middle Ages," and he was honored by Oxford in 1914, nearly 700 years after his work was accomplished.

Albertus Magnus was born in 1193 and died in 1280. His real name was Albert von Bollstadt, and he was also known as Albert Groot. He was therefore a contemporary of and slightly older than Bacon. He was a member of the

Dominican Order, and was successively engaged as a teacher at the University of Paris and the University of Cologne. He subsequently became Bishop of Ratisbon. He did not write on medical practice, as this branch of learning was forbidden to members of his order. He wrote instead on natural history subjects and alchemy. His most famous works are *Physica de Animalibus* and *de Vegetabilibus*. He earned the title of the Christian Aristotle.

He first used the word alkali in literature to describe what we know today under that name, for he prepared the material so called from wood ashes and lime. He also was one of the earliest authors to employ the term "affinity," and to use the word "vitriol" as applied to the sulphates of the metals.

Another of the titles of distinction accorded him by his successors was the "Universal Doctor." He was a prolific writer along many lines. Among the works with which he showed familiarity were several of unknown authorship which had appeared during the previous century. One of these, the *Mappa Clavicula,* describes the testing of metals by the hydrostatic balance; another, the *Book of Seventy,* was believed to be a translation of one of Geber's manuscripts; and a third, called the *Liber Sacerdotum,* concerns it-

self with colors, precious stones and minerals. This latter is a very important work of that period, possibly based upon Egyptian tradition. It contains recipes for making alloys, for coloring metals, for soldering metals, for tinting glass, for making dyes, for making imitations of precious stones, and for transmuting metals. It is equipped with an Arabic-Latin lexicon for translators and users.

Another important work which came out about the time of Albertus Magnus was *The Book of Fires.* This is attributed to Marcus Græcus or Marcus the Greek. It is a kind of techno-chemical recipe book of its day, dealing particularly with inflammable materials and explosives for use in warfare. One interesting operation described in *The Book of Fires* is as follows:

> Take best old wine of any color whatsoever in a cucurbita and alembic with joints well luted and distil with gentle fire. That which distils is *aqua ardens.*

The history of distillation is considerably older than this period, for distillatory apparatus had been described in manuscripts of Synesius the Cyrenian and of Zosimus, both of whom wrote in the fourth century A.D.

It has been stated that Aristotle must have had a knowledge of distillation when he compared

certain meteorological phenomena to the similar changes which can be produced in wine or water, and it seems certain that Dioscorides understood distillation, for he mentions the fact that quicksilver is obtained from cinnabar and iron in an apparatus called an "ambix," which was the word the Arabians converted into "alembic."

Pliny describes the obtaining of oil of turpentine by heating resin and collecting the liquefied vapor on wool which was suspended over the heated resin.

Albertus Magnus was one of the first authors to intelligently describe the concentration of alcohol by distillation. A work on cosmetics, *De Secretis Mulicrum,* which has been erroneously attributed to him, was a huge compilation made by one of his pupils, Henry of Saxony.

Thomas Aquinas, one of the greatest of scholastics, was a pupil of Albertus Magnus. He differed from his preceptor in the fact that his style was obscure, while that of Albertus was very intelligible. Thomas Aquinas first used the word "amalgam" to describe the combination of mercury with another metal.

Raymond Lully was born in 1235 and died in 1315. He was a native of Majorca and was a sedate family man with a wife, two sons, and a daughter at the age of 22. He then commenced

to lead a wild life and became a libertine, to the detriment of his social standing and his fortune. One of the objects of his affection was a virtuous married woman of Majorca, who, in order to check his ardor, showed him her breast, which had been ravaged by cancer. This affected him so strongly that he immediately renounced not only his wild life but his family as well, and set out to study medicine with the object of discovering a cure for such a terrible disease. He first studied at Montpellier, then at Paris, then journeyed through Europe and the Orient. About this time he conceived an antipathy to the Moslems and went about preaching new crusades, having first become a member of the order of Minorites. He later founded a new philosophy, for which he was denounced by the Church as a heretic. He then went to Tunis and tried to convert the natives to Christianity, and was stoned to death for his zeal. He narrowly escaped beatification as a saint for his martyrdom, and his relics are said to have worked many miracles in European churches.

Lully had studied alchemy and was reputed to possess the secret of transmutation of base metals into gold. He is the reputed author of nearly 500 written manuscripts upon literary, moral, metaphysical, theological, and scientific

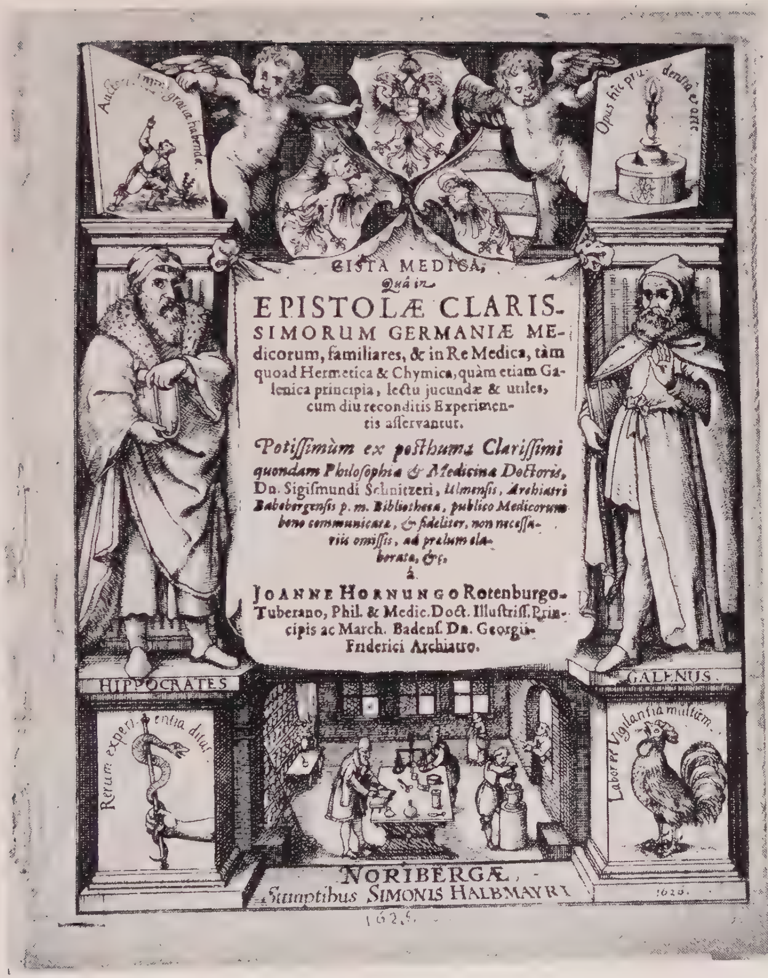

CISTA MEDICA,
Quâ in
EPISTOLÆ CLARISSIMORUM GERMANIÆ Medicorum, familiares, & in Re Medica, tàm quoad Hermetica & Chymica, quàm etiam Galenica principia, lectu jucundæ & utiles, cum diu reconditis Experimentis asservantur.
Potissimùm ex posthuma Clarissimi quondam Philosophiæ & Medicinæ Doctoris, Dn. Sigismundi Schnitzeri, *Ulmensis, Archiatri Babebergensis p. m. Bibliotheca, publico Medicorum bono communicata, & fideliter, non necessariis omissis, ad prelum elaborata, &c.*
à
JOANNE HORNUNGO Rotenburgo-Tuberano, Phil. & Medic. Doct. Illustriss. Principis ac March. Badens. Dn. Georgii-Friderici Archiatro.
NORIBERGÆ, Sumptibus SIMONIS HALBMAYRI 1625.

FIG. 19.—SYMBOLIC TITLE-PAGE OF A SEVENTEENTH CENTURY WORK ON PHARMACY, WITH FIGURES OF GALEN AND HIPPOCRATES, AND WITH A PICTURE OF A PHARMACEUTICAL LABORATORY OF THE PERIOD. SEE PAGE 296.

subjects. He is said to have derived his inspiration in part from Roger Bacon and in part from Arnold of Villanova.

Lully is said to have visited London when he was over seventy years of age, to interest Edward II in waging a new war upon the Saracens. There are several conflicting stories as to what happened next. One account has it that Edward alleged his lack of gold as the reason for his inability to accede to the request, whereupon Lully retorted that this would be the least of the difficulties and proceeded to transmute a lot of base metal into gold for the use of the King, who promptly used the money in waging war upon France instead of fighting the Saracens. Another account says that Edward, hearing of his transmuting ability, shut him up in the Tower and commanded him to replenish the royal coffers by the exercise of his alchemistic art. Tradition then goes on to relate that he transmuted at the King's behest enough base metal to permit of the coinage of six millions of gold nobles. It is said that some of the coins issued at this time are known to numismatists as "rose nobles," from the design of a rose which they bore, and that assays by modern analytical methods prove them to be of purer gold than any other gold coins of that period.

Discrepancies in the details of these stories occur which impair their credibility, but there are several interesting side-lights which are a matter of record, and which serve to confirm in the minds of some the belief in the possibility of such transmutation. One of these is the fact that in Lully's last will and testament he refers to the occasion and says that he had converted 50,000 pounds of base metals into gold. Another is that, within the same century, Henry IV had the following statute enacted:

> None from henceforth shall use to multiply gold or silver or use the craft of multiplication; and if any the same do, he shall incur the pain of felony.

Lully is most famous in pharmaceutical history for his introduction into the profession of the alcoholic preparations of drugs known as tinctures. He had learned the art of concentrating alcohol both by distillation and by dehydration. He was a great booster for the concentrated distillate which he called "*aqua vitæ*" or "*aqua ardens.*" Of it he wrote: " The taste of it exceedeth all other tastes and the smell all other smells," and he describes it as a product "of marvelous use and commodity a little before the joining in battle to encourage the soldiers' minds."

His detailed process for making an article of the finest quality contained some unnecessary

steps, for he directed the use of well-flavored wine, which, before distillation, was to be buried for twenty days in a well-sealed vessel in a pile of fermenting horse dung. Perhaps he developed some of the congeners that we heard so much about in the days of the controversy over "What is whisky?"

Lully also is credited with the earliest description of the methods of preparing ammonium carbonate, nitric acid, red precipitate, and white precipitate. One of his symbolic names for alcohol was *argentum vivum vegetabile,* in the belief that mercury was an essential elemental property or constituent of matter.

He described a product corresponding closely to spirit of nitrous ether, which he classed with the waters, as was done with most distilled products at that time.

Lully's *Secreta Secretorum* is really a pharmaceutical formulary. He is credited with having been instrumental in introducing many of the symbols which came into use soon after his time into pharmaceutical works, but I have my doubts as to this being true, for in a copy of the *Secreta Secretorum* in my possession, which was published in 1592, not a single symbol is used, except for weights in a few cases.

Dr. J. Campbell Brown, the eminent English

historian of chemistry, raises a question as to the authenticity of the alchemistic works of several of the characters whom we have thus far considered. Those of Thomas Aquinas and Lully are stated as being "fictitious" and Albertus Magnus as "doubtful," while Geber, who is considered as doubtful by many other historians, he places in the eleventh century.

There is so much uncertainty regarding these matters that I prefer to give these characters the benefit of the doubt and write of them as real. Certainly some clever person or persons took the trouble to write many books under these respective names, and it is not likely that there was such widespread generosity on the part of anonymous individuals of undoubted talent as to create fictitious characters in such faithful semblance of reality.

Arnold of Villanova was the last of the four great figures of the thirteenth century. He was a Spaniard and was born in 1235 and died in 1320. He was noted as a writer in theology, law, philosophy, and medicine. He became counselor to Peter of Aragon. As he was a fluent user of Arabic, Greek, and Hebrew, as well as of Latin, he drew from a wide variety of sources. He was educated at Montpellier and traveled extensively, during which time he met Raymond Lully, and each seems to have influenced the other.

FIG. 20.—FRONTISPIECE OF PHARMACEUTICAL WORK BY JEAN DE RENOU, 1626, SHOWING A PICTURE OF AN EARLY SEVENTEENTH CENTURY PHARMACY. SEE PAGE 307.

Arnold despised Avicenna and described his works as stupid scribblings. He seems to have been more profoundly influenced by Avenzoar in his beliefs and teachings. He was a student of astrology and wrote a number of alchemistic books with fanciful titles, among which were the *Speculum Alchemiæ,* the *Perfectum Magisterium,* the *Scientia Scientiæ,* and the *Rosarum Philosophorum.* He came under the ban of the Church before his death as a heretic and fled to Sicily, where he died. His alchemistic writings are characterized by their obscurity and evident charlatanry. His medical and pharmaceutical works, on the contrary, are clearly written and very thorough. He was a seeker after the *Aurum Potabile* or elixir of life. He also had the same high regard for the physiological effect of alcoholic distillates as is attributed to Lully, and shares the honors, too, with that authority in the matter of using alcohol as a menstruum for tinctures.

A less celebrated character of the early part of the thirteenth century was Vincent de Beauvais, whose name is Latinized as *Vincentius Bellovacensis.* Like many learned men of that century, he was a monk of the French Dominican Order. He was tutor to the sons of Louis IX, commonly called Saint Louis. His principal

work was called the *Speculum Majus.* It was an encyclopedia of the knowledge of his time, written in Latin, and consisted of 80 books with nearly 10,000 chapters, and contained references to nearly 500 authorities. It was first published in 1473, about two centuries after the author's death.

A celebrated pharmaceutical formulary of the late thirteenth century was the *Thesaurus Pauperum* of *Petrus Hispanus,* Peter of Spain, later and better known as Pope John XXII. This formulary was a curious combination of empiricism and superstition. One of the cures recommended for epilepsy in this work was to carry a parchment upon which had been written the names of the three wise men of the East, Gaspar, Balthasar, and Melchior.

After he was established in his papal palace at Avignon, John became interested in alchemy and had a laboratory of his own. His counselors must have been charlatans or his experiments unsuccessful, for he later publicly condemned the hermetic art as a diabolical deception and issued a papal bull to restrict its practice. Later alchemistic writers assert that this bull was not directed against the true adepts. As he left a legacy of seven millions of florins in jewels and eighteen millions of florins in pure gold, there

are those who find in this fact confirmation of his actual ability as an adept. He is said to have written a treatise entitled *The Elixir of the Philosophers or the Transmutatory Art of Metals.*

Pharmacies, as separate places for the compounding and dispensing of medicines, spread with great rapidity throughout European countries generally during the thirteenth century. In 1233 the first apothecary shop in Germany of which there is any record was at Wetzlar. The first record of a pharmaceutical organization or association is in Bruges, Belgium, in 1297. This was a combination of a secret society and a guild. The organization possessed a spacious hall and also a chapel where divine service was held and new members obligated. They had statutes to govern their proceedings and an official seal. The members of this organization had the exclusive sale of medicines, and included representatives of distinguished families of the community. The corporation later became very wealthy and gave liberally from their funds for municipal and patriotic purposes.

Just before the close of the thirteenth century the most celebrated traveler of the time, who never had the pleasure of giving a travelogue with moving pictures, made his famous tour of the far East. This was none other than Marco

Polo, the Venetian, whose discoveries were neglected and despised by the Venetians themselves, and the publication of which later became the means of depriving the Venetians of the exclusive trade in drugs and spices with the Orient which they had enjoyed for a long time, and which they lost to Portugal at the beginning of the sixteenth century.

In 1314 a famous pharmaceutical formulary was compiled by John of Gaddesden, a pensioner of St. Paul's, and physician to Edward II of England. He called it the *Rosa Anglicana*, because, as the rose excels all other flowers, this work was to excel all similar works. Like the rose, it was divided into five major parts. It was a compilation from Arabian authorities complicated by didactic discourses and astrological leanings. In it the author extolled "*aqua vitæ*" as a "polychrest," or remedy of many virtues. The book contained a lot of unmentionable animal drugs that would shame Serapion.

Gaddesden must have been a keen practitioner, for he speaks of those "disagreeable diseases which ofttimes cure themselves and bring no grist to the doctor's mill." He also advocated *succedanea* for use in the treatment of poor patients who are unable to pay for costly medicines.

A rival of the *Rosa Anglicana* was the *Lilium Medicinæ,* another formulary, by Bernard de Gordon of Montpellier. This evidently preceded Gaddesden's work, for he quotes from it.

As has been previously stated, the Guild of Pepperers, which included drug sellers, had been incorporated in London in 1180. These early guilds were frequently called upon for financial help by the King in time of war. The calls of Edward III for subsidies for his campaigns against France and Scotland drove this first guild upon the financial rocks. The Pepperers were succeeded by the Spicers, who also failed for some unknown reason. These two guilds were then succeeded by that of the Grocers or sellers "*en gros.*" This guild received permission to incorporate from Edward III in 1345, although they did not receive a charter until a century later. Among other objects depicted on the coat of arms of the Grocers were six cloves. In this same year was established the first apothecary shop on record, in London.

In the same year it is recorded that Edward III of England granted a pension of sixpence a day for life to Coursus de Gangland, an apothecary of London, for services rendered during an illness of the King. Some few years before, at

the death of Robert Bruce, a record of payment has been discovered which was made to "John the Apothecary" for supplying embalming materials.

In France, during the fourteenth century, the apothecaries were required to subscribe to a formal oath before being permitted to practice. They swore to live and die in the Christian faith, to speak no evil of their teachers or masters, to do all in their power for the honor, glory, ornament, and majesty of medicine, to give no remedy or purge without the authority of a physician, to supply no drugs to procure abortion, to prepare physicians' prescriptions exactly, neither adding, subtracting, nor substituting anything without the express permission of the physician, to avoid the practices of charlatans as they would the plague, and to keep no bad nor old drugs in their stocks.

In 1352 the King of France issued a law prohibiting any one who was not an apothecary, a student, or a mendicant monk from practicing medicine, and exempted master barbers from serving as watchmen. In this period there were little barbers and great barbers. The little barbers went on foot; the great barbers wore richly ornamented robes and rode horseback. These

latter practitioners carried with them the following favorite remedies: basilicon ointment, Apostolic ointment, white ointment, yellow ointment, and an ointment known as dialtea.

An ordinance in Paris in 1359 provided that no one should be granted the title of "Master Apothecary, unless he can show his ability to read recipes." In Germany conditions must have been much the same, for in Nuremberg in 1350 there was a decree providing that "the pharmacist shall conscientiously fill all written and verbal orders to the best of his ability; that he shall use none but pure drugs; that he shall treat rich and poor with equal courtesy; that he shall be modest in his charges and not demand more than he needs to feed and clothe himself and those dependent upon him."

Monastery pharmacies also existed in Europe at that time, as is shown by references to a *camera dispensatoria* in connection with the monastery infirmary, in many cases. Court apothecaries also began to appear and played an important part in the development of pharmacy in the succeeding centuries. In one of these instances, in the fourteenth century, the ruler agreed to furnish the apothecary with wine and foodstuffs, while in return the apothecary was to supply the court

with confectionery, a rare commodity of the period.

This was the century when the cult of alchemy, handed down by the Arabs, spread like wildfire through the civilized world and reached its culmination several centuries thereafter. At this time, too, came into widespread use the many symbols for processes, substances, etc., which are so extensively employed in the pharmacopœias of the later centuries, some of which have come down to us unchanged.

It was in the latter part of the fourteenth century that Chaucer wrote his Canterbury Tales. Chaucer describes the physician as being grounded in physic, surgery, astronomy, and magic, and evidently looked upon the pharmacist as occupying a subordinate position, for concerning him he says:

> "Full ready had he his apothecaries,
> To send his drugges and his lectuaries."

Chaucer also refers to the physician's acquaintance with such authorities as "Dioscorides, Rufus, Hippocras, Rasis, Avicen, Averrois, Damascene, Constantin, Bernard, Gadesden, and Gilbert." He had not a very high opinion of the physician for piety for he says in this connection: "His study was but little in the Bible," nor did

he hesitate to accuse him of having an itching palm in:

> "He kept that he won in the pestilence,
> For gold in physic is a cordial,
> Therefore he loved gold in special."

In the *Nun's Tale* he confirms the fact that the calling of the apothecary was separate at that time.

> "Though in this town is no apothecary
> I shall myself two herbes teache you."

In the *Yeoman's Tale* Chaucer enumerates the forms of apparatus and the chemicals employed by the alchemist and ridicules their efforts.

In the latter part of the fourteenth century lived Guy de Chauliac, who served as physician to three successive Popes, and who did not contribute much to pharmacy except in the matter of formulas for dentifrices, for he wrote a textbook on teeth and their decay, in which he suggested formulas for tooth powders which were handed down for centuries (see illustration No. 6, opposite page 40).

Probably the last important work which appeared in the fourteenth century was the *Breviarum Bartholomei,* by John Mirfield. This formulary, as its name indicated, originated at St. Bartholomew's Hospital in London. Many of the remedies described have outlandish and

high-sounding names, such as *theodoricon emperisticon*, *diacostorium*, and *tyriacum*, the latter being our old friend theriaca. In this formulary rheumatism was treated by applying warm olive oil, while the pharmacist who was directed to apply it, repeated two psalms, the "Gloria," and two prayers seven times. There were no clocks in these days and this was the method of ensuring a sufficiently lengthy time of application. It has been ascertained that the time in this case would be about thirty minutes.

We have now reached the end of what is known as the Medieval Period and emerge upon the period called the Renaissance. Pharmacy by this time has attained to the dignity of a distinct calling, subservient, it is true, to medicine, but nevertheless separate in its service and its practice. If the restrictions and the implications in the rules and regulations seem harsh, it must be remembered that the physicians themselves had been doing this work and knew what evils to correct. They and not the pharmacists were the original substitutors and dispensers of worthless drugs.

One astonishing fact confronts us when we stop at this point to think about it. All of the works, formularies, antidotaries, and, in fact, everything up to the time where we now pause

for breath, were written by hand. Does it not make one gasp with astonishment at the realization of the labor involved in producing one single copy of a work? And some of those old worthies were such voluminous writers that they must have worked every spare moment to have accomplished what has been credited to them. Think of the pride of ownership of a manuscript in those days when there were few reproductions. Think, too, of the centuries of leadership which some achieved, unplanned and probably undesired, but nevertheless actual, and vital to the progress of any calling or science.

We shall meet a different situation from now on, for whether Johann Gutenberg of Mainz or Laurens Janszoon Coster of Haarlem is to be credited with the invention of printing by movable type, the influence upon the succeeding centuries has been incalculable.

CHAPTER VI

PHARMACY DURING THE FAMOUS FIFTEENTH CENTURY. A CENTURY OF ALCHEMISTIC FRENZY. BEGINNING OF THE RENAISSANCE

The fifteenth century opened without any outward evidence of the marvelous changes it was to bring forth. The Jews, who had been forbidden to practice medicine and pharmacy in Vienna in the latter part of the previous century, were expelled altogether from Spain in 1412, and were banned by the Catholic Church shortly after. Pharmacy in the early part of the century remained in about the same condition as it had been during the latter part of the fourteenth century. In both France and England there was rivalry between the apothecaries and the spicers or grocers, who also sold drugs. In France a temporary separation of privileges was provided by statute, in which the grocers, to their discomfiture, were deprived of the sale of distilled waters. In England the first charter was granted to the Guild of Grocers in 1429, while in 1453 they were given charge of the official weighing of all imported merchandise. Later in the same century they were given the exclusive power of garbling

FIG. 21.—AN ELABORATE TITLE-PAGE OF PHARMACEUTICAL WORK BY JEAN DE RENOU, 1626. SHOWING PICTURE OF MANY NOTABLE CHARACTERS IN THE EARLY HISTORY OF PHARMACY. SEE PAGE 307.

drugs and spices and of examining the drugs and preparations sold by the apothecaries, who were subservient to them; that they exercised the authority is shown by the record of a fine imposed upon an apothecary for making an untrue preparation.

The requirements for entrance to the study of pharmacy and for registration in the calling in France were very severe in this century. A four years' apprenticeship was essential. Certain studies, including Latin, had to be pursued. The apprenticeship feature remained unchanged for over 300 years, and is still reflected in the "experience requirement" of the pharmacy boards of most States, although the need for it has largely disappeared, and its value at the present time is problematical. Experience is also required in many European countries. The applicant for registration as a journeyman apothecary, corresponding to the assistant of today, was required to dispense prescriptions, recognize unlabeled specimens of drugs, and prepare difficult preparations in the presence of master apothecaries who were appointed as examiners. Before the journeyman could become a master apothecary, ten years of additional experience were required.

The police regulations of Basle in the first

half of the fifteenth century throw an interesting light upon the situation. It was provided that "what costly things people may wish to have from the apothecary shop they must pay for." Does this refer to some of the expensive medicaments of the time or was the fifteenth century flapper in the habit of running up bills for perfumery and confectionery which father ultimately had to pay? In Dijon, at about the same period, a law was enacted providing that no pharmacist could receive a legacy from one of his clients, although he was given the first claim on the estate of a deceased debtor.

In most European countries outside of England the practice of limiting the number of pharmacies in a community had become firmly established. In some cities at this time, notably Augsburg, the pharmacist was under municipal control and was paid a salary by the city. An interesting record of this time exists in Halle, when the Archbishop gave to his personal physician, Van Wyke, the right to open a second apothecary shop in the community, with the assurance that "no more should be permitted in the city to eternity."

In 1438 the preliminary work of Coster, Fust, and Schöffer culminated in the use of movable

type in printing by a German whose real name is Gänsfleisch (gooseflesh), but who is better known to fame as Gutenberg. This was soon followed by the establishment of the Elzevir Press in Holland and the Caxton Press in England, and the world was soon deluged with printed books, first the Bible, and later the scientific works which, for all previous time, had been accumulating in manuscript form. The period of the Renaissance had begun in earnest and its speed was accelerated by the fall of Constantinople in 1450, thus opening the door to more satisfactory traffic between the East and the West, in things both material and intellectual.

One of the earliest printed works extant contains an illustration of a fifteenth century pharmacy (see illustration No. 7, opposite page 46). It is from a book called *Ars Memorativa* by Anton Sorg, published in 1470. This illustration is familiar to most readers of pharmaceutical history, as it has been frequently reproduced. It shows in the foreground a pharmacist contusing something in a large three-legged mortar, which is supported by a heavy pedestal. The pharmacist has a far-away look in his eye, and carries his nose at an elevation that would presuppose some objectionable odor emanating from the operation. The

background shows three sides of the shop, which are entirely occupied with shelves crowded with containers.

Another interesting illustration of a fifteenth century pharmacy is taken from a book published in Augsburg in 1486 called *Ortus Sanitatus* (The Garden of Health) (see illustration No. 8, opposite page 56). In the center of the picture is a young workman (probably the apprentice) engaged, as was his confrère in the picture previously described, in contusing some drug in a large, deep mortar standing on a pedestal. This young man seems more interested in his occupation and is seen looking down into the mortar while he works. On a near-by counter are scales, utensils, and notebooks. Three sides of the store are shown as a background, which, as in the other store, are completely filled with shelves upon which are containers of various shapes and sizes, bearing symbolic or heraldic labels. At the right is an open door or window showing a rural landscape. In the foreground are the silhouetted heads of five closely grouped figures. These are the masters of the art, as indicated by the text—Galen, Dioscorides, Pliny, Avicenna, and Serapion.

Still another fifteenth century drug-store is shown in an illustration in a book by Hieronymus

Brunschwygk (Brunswick), which mainly treats of distillation (see illustration No. 9, opposite page 68). In this picture the pharmacist, who is clad in long flowing robes, and who is badly in need of a haircut, is standing in the foreground with a stick or pointer in his left hand, which is directed toward a container in the middle of the lower of two shelves, which are filled with tall, narrow containers, bearing the same kind of symbolic label as in the former picture described. His assistant is seen seated at a large wooden table with a folio volume open before him and two containers standing near it on the table, one of which has the lid removed and lying close by. Whether the subject is intended to be a lecture on electuaries, or an inventory, it is hard to determine.

A pharmaceutical laboratory of the fifteenth century forms the subject-matter of another early illustrator (see illustration No. 10, opposite page 76). In it we again see the pharmacist of the type shown in the previous illustration, with the turban-like headdress and the flowing robes. He holds in his hand a large container which he is evidently bringing to the assistant, who is seated on a three-legged stool attending to an operation in which a long-handled casserole is being heated

over an open fire on a large elevated hearth. In the background are seen various forms of apparatus hanging against the wall. The assistant is somewhat of a puzzle in this case. It is hard to tell whether it is a youth or a maid, just as it is sometimes difficult today, and for the same reason —" knickers."

One of the most interesting of the fifteenth century illustrations (not reproduced in this work) which has come down to us is another from the book on distillation by Brunschwygk previously mentioned. It is the *Preparation of Theriac.* It was required by law in many communities for the pharmacist to expose the ingredients from which theriac was to be compounded in a public place for a certain length of time before the important day of its preparation, which was more or less of an official occasion. In this illustration is seen a large table covered with a cloth, standing in a public square. On the table are many containers of different shapes and sizes. Two official-looking personages are evidently engaged in the operation of preparing this most important medicament. They are wearing both robes and locks in the flowing condition.

A pharmaceutical formulary and materia medica called *Liber de Proprietatibus Rerum*

was written during the fifteenth century by an English monk named Bartholomew Glanvil.

John de Castro, a native of Padua, first manufactured alum in Italy during the fifteenth century. Alum was in great demand as a mordant in dyeing and had previously been obtained from Syria. For this enterprise he was richly rewarded by Pope Pius II, and a monument was erected to his memory upon which was inscribed "*Joanni de Castro Aluminis Inventor.*"

In 1480, in the time of James I of Scotland, there was evidently an outbreak of criminal poisoning, for that monarch is said to have issued a law to the effect that "All persons are forbidden to bring home poison from which any Christian man or woman can take harm."

We have arrived at a period where we can actually see what contemporaneous illustrators visualized as the pharmacies of the time. It is probably true that in many cases during this century and later, the pharmacist had been a physician or was engaged in medical practice as well. It will be seen, therefore, that pharmacy and medicine, which had been so intimately associated for thousands of years that both arts (for they can scarcely have been called professions at that early date) had been practiced by the

same individual, had effected a separation which has become more and more distinctive during the passage of the years that have since elapsed.

During the centuries that had passed since the time of Geber there had grown up a new science, or rather pseudo-science, called alchemy, which had its contacts with both pharmacy and medicine—with pharmacy because, as an operative art requiring apparatus and a laboratory, its practitioners could experiment along the lines of pharmacy and alchemy both; with medicine because the search for an elixir of life or a universal antidote was usually associated with the search for the philosopher's stone, as the medium of transmutation was called.

Concerning this alchemistic search for this *ignis fatuus,* Mr. M. Pattison Muir has said:

> For thousands of years before men had any accurate and exact knowledge of the changes of material things, they had thought about these changes, built on them theories of things in heaven and earth (and a good many things in neither), and used them in manufactures, arts, and handicrafts, especially in one very curious manufacture wherein not the thousandth fragment of a grain of the finished article was ever produced.

That the art of chemistry, or alchemy, had completely outstripped the science, will be appreciated when it is remembered that fermenta-

FIG. 22.—ELABORATE TITLE-PAGE FROM *Antidotary of Bologna*, 1641. SEE PAGE 274.

tion, metallurgy, textile working, dyeing, glass manufacture, and many other processes had reached a high degree of perfection from an empiric standpoint, and this before even the simplest step of any one of these processes could have been logically or correctly explained, and when there were believed to be but four elements —earth, air, fire, and water, to which were added later the principles, salt, sulphur, and mercury.

The impetus given to this search by such figures of the thirteenth century as Bacon, Albertus Magnus, Raymond Lully, and Arnold of Villanova, had a far-reaching effect. There were other workers in this line during the centuries preceding the fifteenth, to whom reference may here be made.

Alain of Lisle, also known as *Alanus Insulensis,* was a dabbler in the hermetic art, and is said to have written a work entitled *Dicta de Lapide Philosophico.* Jean de Meung was another thirteenth century figure of some importance. He was one of the contributing authors to an epic poem of considerable length which appeared during that century, called *Roman de la Rose* (The Romance of the Rose), in which the secrets of the *magnum opus* were presented in allegorical form in verse. He was also the author of two works called respectively *Nature's Remon-*

strances to the Alchemist and *The Alchemist's Answer to Nature.* He directed in his will that he should be buried in the Church of the Jacobins at Meung. He left the brethren of the order a coffer, which from its weight they believed to be filled with hermetic gold. He had provided that the coffer should not be opened until after his funeral. The monks, on opening it after Jean's body had been solemnly interred, were chagrined and disappointed to find only a number of large pieces of slate covered with geometrical designs and numbers. The indignation of the Jacobins was so great that they were on the point of ejecting Jean's body from its consecrated grave, but the French Parliament intervened in time to ensure him his permanent resting-place.

In the fourteenth century a Jesuit monk named Ferarius had written two works on transmutation. They were *De Lapide Philosophorum* and *Thesaurus Philosophiæ.* They are both vexingly obscure, but the author frankly states that when the philosophers speak plainly it is for purposes of concealing the truth, and that the " light of Hermes " may be found only in their incomprehensible profundities.

Nicholas Flamel, who was another fourteenth century adept, is the central figure of many

marvelous legends and traditions. He is said to have suddenly come into great wealth while pursuing his alchemistic researches. This wealth he employed in charitable endowments and pious foundations that sanctified his memory and long survived him as material proof of his generosity. The detailed account of his striving and of his ultimate success, as written by himself and found in Waite's *Lives of Alchemystical Philosophers,* reads like a romance. He is said to have established, built, and endowed fourteen hospitals, three chapels, and seven churches in Paris, and to have left in one of the arches in each structure the secret signs and symbols of the hermetic art. Some of these secret marks were claimed to have been identified by Langlet du Fresnoy in 1742, nearly three centuries after Flamel's death. He left a work called *The Treasure of Philosophy* (*Trésor de Philosophie*), whose text has been studied by many who have sought to duplicate Flamel's success. In it he claims that the *prima materia* is mercury, which is the seed of all metals.

Peter Bono, also known as Peter of Abano (Petrus Apponos), an Istrian of the fourteenth century, published a complete treatise on the art of transmutation under the title of *Margarita Pretiosa,* or *The Pearl of Great Price.* This is a comprehensive historical account of the history,

the theory, and the practice of alchemy, and has been translated and reprinted in modern times as an example of the literature of this period. This same Peter was called the " Great Lombard " by physicians of that and succeeding centuries because of his famous medical work, *Conciliator differentiarum.*

Johannes de Rupecissa is considered by some to be one of the greatest of the hermetic philosophers. He is said to have been a French monk of the order of St. Francis. He was imprisoned by Pope Innocent VI in 1357 for presuming to reprehend his ecclesiastical superior. He wrote *The Book of Light* and *The Five Essences,* but his most celebrated treatise was *De Confectione Lapidis* (concerning the manufacture of the stone). He refused to openly divulge the secret for fear of revolutionizing the whole world.

We are now back in the fifteenth century, from which we recently digressed in connection with this interesting alchemistic by-path. Here we enter a frenzied period which is full of puzzling circumstances and contradictions. The first problem that engages our attention concerns a character named Basil Valentine. Who was he? When did he live? Was there such an individual at all? Many modern writers accept the authority of a

work called the *Dictionary of the Occult Sciences*, in which the following statement appears:

> His life is so mixed up with fables that some have disbelieved in his existence. He is represented as flourishing in the twelfth, thirteenth, fourteenth, and fifteenth centuries. It is even added without the smallest proof that he was a Benedictine at Erfurt.

However, a history of the City of Erfurt written by J. M. Gudemus in 1675 assures us that the public records of that time show Valentine to have been an inmate of the house of the Benedictines in 1413 and that he had distinguished himself by a profound knowledge of nature. Waite, the modern historian of alchemy, states that Basil Valentine was born at Mayence and was made Prior of St. Peter's in Erfurt in 1414. According to Olaus Borrichius, a celebrated Danish author of the seventeenth century, Valentine enclosed his secret writings in a hollow pillar of the abbey church, where they were discovered after a thunderbolt had damaged the edifice many years after his death. Another historian states that the manuscript was hidden back of the altar, where it lay unnoticed for several hundred years.

Valentine's greatest reputation is associated with the element antimony, which he is said to have discovered. The name of the element is said to have originated from the fact that he, having first

experimented upon the pigs of the monastery without adverse effect, tried the effect of his antimonial preparations upon his monastic brethren, upon whom the medicine acted with such violence that he was led "to distinguish this mineral by the name *antimoine*—meaning hostile to monks." This story has many internal evidences of improbability, but as it is a good story it will probably be retained in the chemical text-books.

The best-known work attributed to him is the *Currus Triumphalis Antimonii* (The Triumphal Chariot of Antimony) (see illustration No. 11, opposite page 84), which appeared in German many years after Valentine's death. In this work he exalts antimony as an excellent medicine for those who are acquainted with alchemical secrets. To others, he says, it is a poison of the most powerful nature. Many other works have appeared in his name, such as *Apocalypsis Chymica, Manifestatio Artificiorum, Tractatus Chimico-Philosophicus de Rebus Naturalibus et Præternaturalibus Metallorum et Mineralium.*

In his works he shows his acquaintance with the method of making hydrochloric acid from sea salt and sulphuric acid, with the method of making brandy by the distillation of beer and wine, and with the concentration of alcoholic distillates

by dehydration with potassium carbonate. He was also familiar with the precipitation of copper in the metallic form by inserting a piece of iron in a solution of copper sulphate. His writings are a mixture of chemistry and piety and he is a severe critic of the physicians and apothecaries of his time. He says: "The doctor knows not what medicines he prescribes to the sick, whether the color of them be white, black, gray, or blue, he cannot tell; nor doth this wretched man know whether the medicament he gives be dry or hot, cold or humid." "Furnaces stand in the apothecaries' shops, towhich they seldom or never come." "A paper scroll on which the usual recipe is written serves their purpose to the full, which, being by some apothecary's boy or servant received, he with great noise thumps out of his mortar every medicine and every health of the sick."

He thus admonished his contemporary practitioners:

> Ah, you miserable people, physicians without experience, pretended teachers who write long prescriptions on large sheets of paper; you apothecaries with your vast marmites, as large as may be seen in kitchens of great lords where they feed hundreds of people; all you so very blind, rub your eyes and refresh your sight that you may be cured of your blindness.

The author who is given credit by several pharmaceutical and chemical historians with having created the fictitious character of Basil Valentine is Johann Thölde, a German chemist of the early seventeenth century.

Isaac Hollander and his son of the same name were contemporaries of Valentine. They are the first recorded alchemists of Holland. Their work must have been valuable from the practical standpoint for they are frequently quoted by Paracelsus, Boyle, and others. They worked principally with metals, describing every process with the most minute detail. They were particularly successful as imitators of precious stones and in the manufacture of enamels. They believed in transmutation sincerely and devoutly and stated that the *Grand Magisterium,* as they called it, was capable of converting a million times its own weight of base metals into gold and that any person taking regularly a small portion of the philosophical stone will ever be preserved in perfect health, and his life will be prolonged to the very last hour which God has assigned to him. Their principal work was called *Opera Mineralia sive de Lapide Philosophico.*

Bernard Trevisan was the son of a distinguished physician of Padua and was born in 1406. His career was contemporaneous with those of

Valentine and the two Isaacs of Holland, but he worked in apparent ignorance of their existence. He began the study of alchemy at the age of fourteen from the books of Geber and Rhazes. His tuition was very costly at the start, for he is said to have expended 3000 crowns in unsuccessful attempts at transmutation. A host of pretended philosophers and teachers offered their services and he was the victim of their knavery or misguided zeal for several years. He then associated himself with a monk, a sincere searcher for the secret, and they experimented together for some years unsuccessfully. At the end of fifteen years he had purchased a perfect knowledge of how not to accomplish the quest, but he had also accumulated much valuable information as a practical by-product of his studies. He next betook himself to prayer and further experiments, this time with sea water, in which he hoped to find the secret. Five years were devoted to one single operation, but without avail, and this experiment was abandoned.

He was now forty-six years of age and at the end of his experimental resources, but not discouraged. He then determined to travel in search of a true alchemist who could teach him. He met with a monk named Lemorier, who was in possession of an untried process of great promise. They

purchased 2000 eggs and boiled them hard. The shells were then removed and calcined and the yolks were separated from the whites and putrified by burying for some time in horse manure. The resulting mess was subjected to countless repeated distillations. For eight years these two patient searchers followed this fruitless and illusive quest.

Disappointed but not disheartened, Trevisan next went to Bruges, where, in company with a theologian who had alchemistic aspirations, he spent several years trying to extract the philosopher's stone from copperas and vinegar. He then suffered a severe illness of more than a year. Upon his return to health he journeyed to Germany, where he became associated with the Confessor of the Emperor Frederick III, who was supposed to be in possession of the great secret for which he was searching. This time they worked with mercury, silver, olive oil, and sulphur. At the end of some months he was convinced of the failure of this trial also, and in utter despair he declared that he would abandon all further experiments. But it was not so to be. In spite of the remonstrances of his family, at the end of two months he enthusiastically resumed his travels and his quest. This time he visited Spain, Italy, England, Scotland, Holland,

Germany, and France. Tiring of western Europe and seeing no hope there, he spent several years in Egypt, Persia, Palestine, and Greece.

In every country visited he found alchemists at work, but nowhere could he find one who had been successful, in whom he had confidence. He had now expended his entire estate and was sixty-two years of age. He was on the threshold of misery and poverty. He went to the Isle of Rhodes, where he intended to live unknown and conceal his disgrace and mortification from his family. Here he met a sincere and pious adept in whom he at last had confidence. He borrowed eight thousand florins and he and the monk spent another fruitless three years and had expended all that he had borrowed.

He finally turned to a study of the writings of many philosophers, and after eight long years, at the age of seventy-three, he claimed to have discovered the secret. He put it to proof and success crowned his efforts. Despite his age at the time of the discovery he is said to have lived for some years in the enjoyment of his tardy reward.

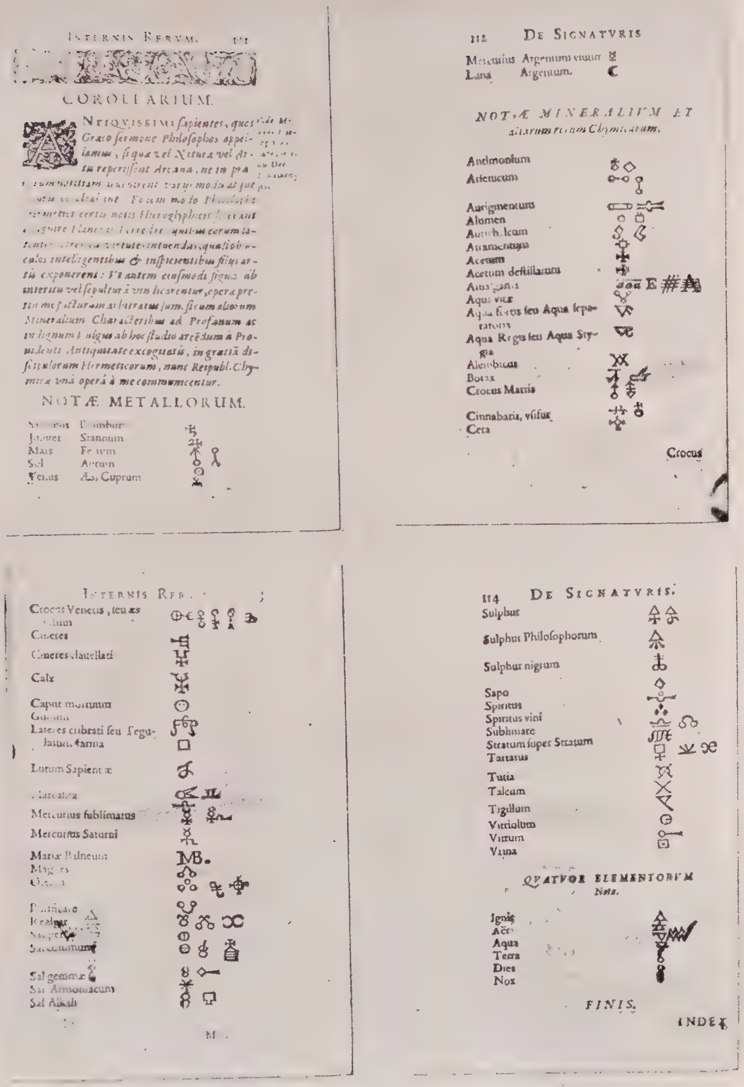
Trevisan wrote but one work, *The Natural Philosophy of Metals.* In this work he conceals the true explanation by the use of the same kind of enigmatic language that had lured him through an entire lifetime of effort.

John Fontaine was a native of Valenciennes. In 1413 he wrote a hermetic poem, *Aux Amoureux de Science,* after the fashion of the *Romance of the Rose,* previously mentioned.

Thomas Norton was a native of Bristol, England. He wrote anonymously, but in the *Ordinall of Alchemy* is found the following couplet:

> "Thomas Norton of Briseto
> A parfet master you may him trow."

This couplet is found by piecing together the initial syllables in the first six lines and the first line of the seventh chapter of the work mentioned. At the age of twenty-eight, and within the space of forty days, he is stated to have mastered the entire secret of chemistry. He embarked upon the experiments which were to make him wealthy beyond the dreams of avarice. The first experiment was spoiled by a careless servant. The second time he was successful in producing the liquid which was to accomplish the transmutation, but he complains that it was stolen from him by the wife of a local merchant who suddenly thereafter acquired great wealth, became Mayor of the city, and built several noted edifices of his time. It does not appear that Norton ever profited by his discovery.



INTERNIS RERUM.

COROLLARIUM.

NOTÆ METALLORUM.

Saturnus	Plumbum	♄
Jupiter	Stannum	♃
Mars	Ferrum	♂
Sol	Aurum	☉
Venus	Æs, Cuprum	♀

112 DE SIGNATVRIS

Mercurius	Argentum viuum	☿
Luna	Argentum.	☾

NOTÆ MINERALIUM ET aliarum rerum Chymicarum.

Antimonium
Arsenicum
Auripigmentum
Alumen
Auricalcum
Atramentum
Acetum
Acetum destillatum
Amalgama
Aqua vitæ
Aqua fortis seu Aqua separatoria
Aqua Regis seu Aqua Stygia
Alembicum
Borax
Crocus Martis
Cinnabaris, vistur
Cera

Crocus

INTERNIS RER.

Crocus Veneris, seu æs ustum
Cineres
Cineres clavellati
Calx
Caput mortuum
Lateres cribrati seu Fegulatum farina
Lutum Sapientiæ
Mercurius sublimatus
Mercurius Saturni
Matrix Balneum
Sal gemmæ
Sal Armoniacum
Sal Alkali

114 DE SIGNATVRIS.

Sulphur
Sulphur Philosophorum
Sulphur nigrum
Sapo
Spiritus
Spiritus vini
Sublimare
Stratum super Stratum
Tartarus
Tutia
Talcum
Tigillum
Vitriolum
Vitrum
Urina

QUATUOR ELEMENTORUM Notæ.

Ignis
Aër
Aqua
Terra
Dies
Nox

FINIS.

INDEX

FIG. 23.—PAGES FROM *Basilica Chymica* BY OSWALD CROLLIUS, 1643, SHOWING EXTENSIVE USE OF SYMBOLS BY THE ALCHEMISTS. SEE PAGE 277.

In Norton's work he says that "Alchemy is a wonderful science, a secret philosophy, a singular grace and free gift of the Almighty;" also that

> "It helpeth a man when he hath neede,
> It voideth vaine glory, Hope and also Dreade."

Thomas Dalton is the name of another fifteenth century English adept who is claimed to have successfully made one thousand pounds of gold from base metal in less than twelve hours. He claimed to have received the powder with which it had been accomplished from the Canon of Litchfield, but that he had been in so much danger on account of the secret that he had destroyed it.

Sir George Ripley, of York, England, better known as Canon Ripley, is one of the most interesting and best known of the alchemistic authors of the fifteenth century. In the quiet cloisters of monastic life he had studied the works of the transcendental philosophers. In consequence of his disappointment at being unable to fully comprehend their writings, he left the monastery and traveled. He visited France, Germany, and Italy, and became acquainted with the leaders of thought. He later visited the Isle of Rhodes, where he is said to have given the equivalent of

a million dollars to the Knights of St. John. He was dignified by the Pope and later at his own request he received an indulgence from Pope Innocent VIII, permitting him to live in solitude, exempt from regular duties and observances.

In this uninterrupted leisure he wrote twenty-four works, some on theological, but mostly on scientific subjects. The *Twelve Gates of Alchemy* is his most famous work. This was written in 1441 and in it he states that all of his previous writings upon the subject were to be discredited as incorrect or incomplete. His alchemistic writings are in verse, and for the most part are unintelligible on account of the puzzling metaphors they contain. Here is a sample:

> "The bird of Hermes is my name,
> Eating my wings to make me tame.
> In the sea withouten lesse
> Standeth the bird is Hermes——
> Eating his wings variable
> And thereby maketh himself more stable.
> When all his feathers be agone
> He standeth still there as a stone;
> Here is now both white and red,
> And also the stone to quicken the dead;
> All and some withouten fable,
> Both hard and nesh and malleable,
> Understand now well aright,
> And thanke God of this Light."

Ripley must have had some of the same disheartening experiences reported by Trevisan, according to the following quotation:

"Many amalgame did I make,
Wenying to fix these to grett avayle,
And thereto sulphur did I take;
Tartar eggs whyts, and the oyl of snayle,
But ever of my purpose did I fayle;
For what for the more and what for the lesse,
Ever more something wanting there was."

After giving a long list of ingredients he thus continues:

"Thus I roastyed and boyled, as one of Geber's cooks,
And ofttymes my wynning in the asks I sought;
For I was disceyvyd wyth many false books,
Whereby untrue thus truly I wrought;
But all such experiments avayled me nought;
But brought me in danger and in combraunce,
By loss of my goods and other grevaunce."

The last of the fifteenth century writers upon alchemistic subjects was John Picus, Earl of Mirandola. Under the title *De Auro,* he wrote a treatise in which he records his conviction of the success of transmutation and describes several successful "projections."

Henry VI, who reigned during the first half of the fifteenth century in England, was evidently both in need of money and possessed of confidence

in his alchemistically inclined subjects, for he issued four successive decrees, commanding all nobles, doctors, and professors to conduct experiments in transmutation with a view to discharging the nation's debt. In his last decree he included priests because their experience in the miracle of transubstantiation well qualified them for success in transmutation.

Frederick III, who reigned during the latter part of the fifteenth century in Germany, was so enamored of the alchemistic search that he surrendered his throne to his son Maximilian and retired to his castle at Linz, where he devoted the remainder of his life to astrology, alchemy, and botany.

Italy fairly swarmed with alchemists late during this same century. The senate of Venice in 1468 passed stringent laws prohibiting the practice of the art.

In 1493 the senate of Nuremberg enacted laws intended for the suppression of alchemy—"for many people have, by its practice, not only been ruined in purse, but have also experienced irreparable injury to their moral nature, and have fallen into disgrace."

In this same century another act was passed in England which ordains "That no one shall henceforth multiply gold or silver, nor use the

craft of multiplication, because many persons by color of this multiplication make false money, to the great detriment of the King and the injury of the people."

During the fifteenth century, Venice had been building up her control of the spice and drug trade, which she had monopolized since the defeat of her only serious rival, Genoa, late in the fourteenth century. Venice was built upon the sea, was dependent upon the sea, and thrived upon the sea. The later crusaders had taken advantage of her geographic position and had used this city as an embarkation point, which she turned to advantage in the development of her commerce. At the peak of her affluence it is estimated that the Venetian traffic in drugs and spices together amounted to nearly fifteen million dollars annually.

At this period there were afloat upon the Mediterranean, and up the west coast of Europe to London and Bruges, more than 300 great galleys or argosies (the latter named from Ragusa, a neighboring Dalmatian seaport where these vessels were built), and for their protection she owned and employed forty-five war galleys. The Rialto was then the center of the commercial life of Venice. It is a mercantile exchange built upon an island of that name. Here were attracted

together by bonds of common interest the money lenders, professional men, and merchants of Lombardy, Navarre, Tuscany, Bavaria, Hungary, Florence, Catalonia, Germany, Brabant, England, and Flanders. Here it was that Shylock heard the news of the result of Antonio's ventures. Rich man, poor man, beggar man, thief, doctor, lawyer, merchant, chief—all commingled in enterprises of speculative possibilities.

The merchants from other cities than Venice were subjected to severe and humiliating restrictions. They were required to live in warehouse-hotels constantly under the supervision of Venetian officials, who saw to it that neither the State nor local merchants were cheated. They might trade with Venetians but not with each other, and each foreign merchant, before leaving, must dispose of his entire stock, even if at a loss.

The drugs and spices sent to Germany went over the Alpine route in heavily guarded pack trains. Western Europe and England were served by the fleets of galleys previously mentioned—Flanders galleys, they were called. Each galley was rowed by 180 oarsmen, protected by archers. Among the ports of call were Pola, Corfu, Alicante, Almeria, Cadiz, and Lisbon. The terminus was Bruges, where mer-

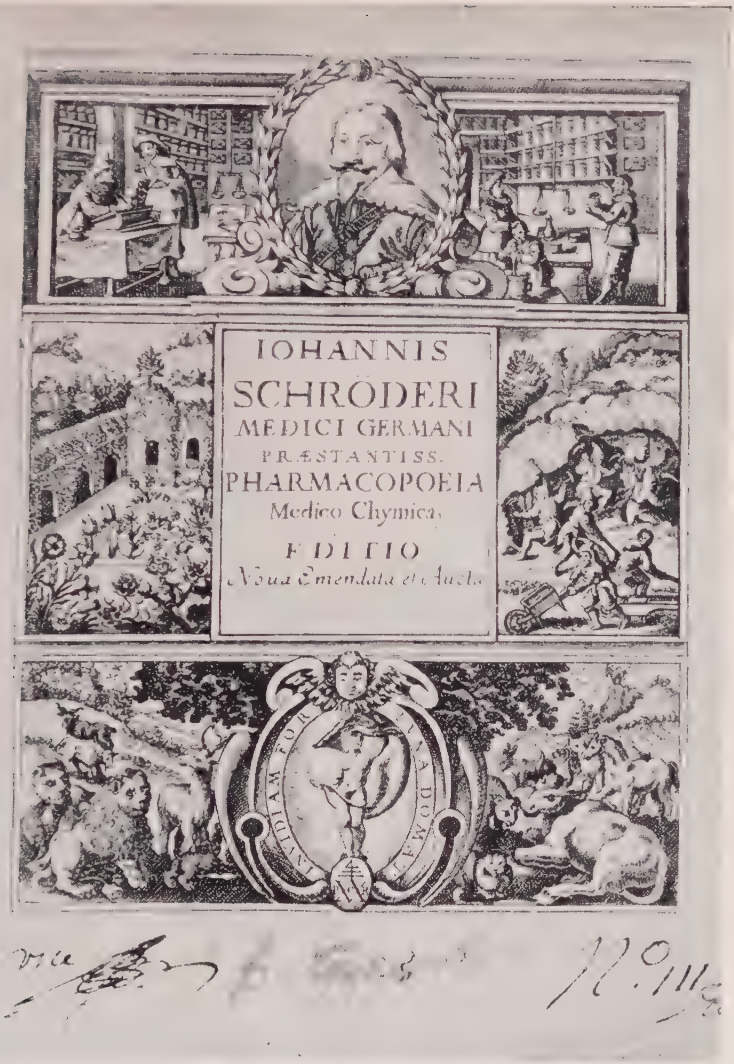


FIG. 24.—FRONTISPIECE FROM THE *Medicochemical Pharmacopoeia* OF JOHN SCHROEDER, 1646, SHOWING A PICTURE OF AN EARLY SEVENTEENTH CENTURY PHARMACY AND SOURCES OF *materia medica*. SEE PAGE 275.

chants of the Hanseatic League and of the Fuggers' (an organization sponsored by a family of that name and having great commercial power in this period) took charge of future distribution. Some few galleys reached London or Southampton direct.

And so came about the distribution of senna, of camphor, of rhubarb, of opium, of theriac, of sugar (for at that time sugar was a drug), and the savory and pungent cloves, cinnamon, nutmeg, mace, pepper, and ginger, and many others as well.

Venice was a typical merchant republic. The sons of her best families were sent upon Flanders voyages to serve their apprenticeship to commerce. The grateful acknowledgement which the Venetians accorded to the sea as the giver of prosperity was attested by the famous annual ceremony of the symbolic marriage of the Doge to the Adriatic, a golden circlet being tossed into the sea with these words: "We espouse thee, O sea, as our bride and queen."

Marco Polo, in the previous century, had helped to lay the foundation of the power of Venice by his extensive travels in the Orient. His knowledge was made available by the fact that he was captured by the Genoese in one of the

numerous wars between these rival republics, and it was during his enforced detention as a prisoner in Genoa that he gave his information to a fellow prisoner, who in turn gave it to the world.

Many drugs and spices were both precious and expensive at this time, due to the fact that the supplies from the Orient were all brought for a great part of the distance by overland caravan routes. There were many dangers in such transportation and many who took toll in profit or tribute on the way. The dream of western merchants of an all-sea route which would reach the sources of the Oriental supply became an obsession.

We are apt to look upon the famous early navigators as altruistic of motive or imbued with the spirit of adventure alone. We forget that their heroism usually had a background of selfish or mercenary interests, and that the voyages of Columbus, da Gama, Magellan, the Cabots, Vespucci, Gilbert, Drake, and others had for the primary object the discovery of a more direct route to the far-away lands from whence came drugs and spices often worth their weight in silver or even in gold.

The fabulous northwest passage and its mythical northeast counterpart were but a possible

means to a selfish end. The Portuguese—always intrepid mariners—were the first who found the route to the Orient by sea. Profiting by charts and tales of Marco Polo, Prince Henry, King John, and King Manuel successively strove to accomplish the result.

In the course of the search they opened up new territories along the western coast of Africa and in 1486 had reached the Cape of Good Hope. The last decade of the fifteenth century saw the fruition of their hopes, for in 1498 Vasco da Gama had made the first successful voyage to India from Europe, and the dominance of the drug and spice trade of the world by Venice was gone forever.

Six years previously Columbus had reached what he at first thought was India, by sailing due westerly from Spain. Thus within a brief span of a few years, the quest for drugs and spices, which were then largely used and esteemed for their remedial properties, had resulted in the discovery of a new hemisphere and the establishing of cheap and direct maritime communication with the Orient. The fifteenth century had proved its worth.

And then, just for good measure, it would seem, two great characters appeared toward the close of the century.

Leonardo da Vinci is probably best known as an artist. In adition to his mastery of art, however, he had accomplished much in science, in anatomy, and in mechanics. He was possessed of great mathematical ability and is said to have anticipated some of the views of Copernicus, who was almost a contemporary, being but a few years later. He constructed a device in which steam (or smoke, as he called it) was used as the propelling force, thereby forming a connecting link between Hero and James Watt. In physics he invented the camera obscura and he made observations in natural history which are remarkable for their accuracy.

In order to better portray the human figure in his art he had studied anatomy at the dissecting table. His sketches made at that period number 750 and are classics in medical literature. His secretive nature led him to make his marginal notes on these sketches in mirror writing, at which he was an expert. He paved the way in anatomy for Vesalius, that great medical figure of the early sixteenth century, who made of the study a living, working science.

The other figure of the close of the fifteenth century was Copernicus, but as his principal work was done in the sixteenth century, detailed discussion will appear in the next chapter.

Pharmacy seems at first glance to have made but little progress during the fifteenth century, but when we reach the next century we shall see that this period of apparent stagnation was in reality but a marking time, or a pausing for breath, for in proportion as alchemy recedes from the centre of the stage, pharmacy advances to the foreground.

It is much to the credit of the pharmacists of the time that few of their number were among the swindlers and charlatans of this century and the next, and that the real progress which was made toward scientific advancement of pharmacy and the abandonment of the disgusting and polypharmacal combinations came about, not from the efforts of specialists in either medicine or chemistry, but in consequence of the missionary work of those who were primarily pharmacists.

CHAPTER VII

THE GLORIOUS SIXTEENTH CENTURY IN PHARMACY—THE CENTURY OF PARACELSUS. PHARMACY AND SCIENCE

> "In my shop of drugs are stored
> Many things of sweet accord,
> Spices with sugar I combine,
> Enemas and purges I divine.
> To strengthen the weak and the sickly,
> Refreshing draughts I furnish quickly.
> All these with utmost care,
> On prescriptions I prepare."

AND so, the next time you see the sign "Prescriptions carefully compounded," you will know where to find its prototype, for the foregoing quotation comes from a book of the sixteenth century by Hans Sachs called the *True descriptions of all professions.* In this book is shown an apothecary shop of the period (see illustration No. 15, opposite p. 120). It is evidently a "one-man-store" and the proprietor is contusing something in large mortar, while several customers and a tired-looking dog await his pleasure. Upon the shelves in the background are cones of sugar, and many containers bearing symbolic or heraldic labels as in the preceding century.

A pharmacologist who looked at this picture immediately stated that the dog appears to be under the influence of cannabis, and argued that it was proof of biological experimentation at that time.

We may suspect that this illustration is one which the author took from an older book, for a different picture of a contemporary drug store is shown in a book called *The Reformation of Pharmacy,* by Otto Brunfels of this same century. (See illustration No. 16 opposite p. 128.) Pharmacy reformers will please note the length of time that the reform is taking. The slogan should evidently be changed to "the first *thousand* years are the hardest."

The ubiquitous assistant with the large contusion mortar is again depicted. A second assistant (indicating a period of greater prosperity for the pharmacist) is seen in another part of the store removing a container from the top shelf. The long-robed proprietor is seen in the foreground in conference with a physician concerning a prescription which he holds in his hand. Elaborate table coverings also distinguish this store and give an air of prosperity. The shelf containers no longer bear heraldic labels, but the outlines of the labels are like those in use today.

A third illustration from *A Book of Confec-*

tions by G. Ryff of Strasburg, shows again the view of a one-man store. The sole occupant is again pounding some drug in a large mortar. A dried crocodile hangs suspended from the ceiling. The shelves are filled with containers of different shapes and sizes. (See illustration No. 14, opposite p. 110.)

These illustrations, especially the latter, remind one of Shakespeare's uncomplimentary word picture of the apothecary in Romeo and Juliet, to which detailed reference will be made later.

This was the time when pharmacy had really begun to come into its own. Drugs were rare and very costly and the prescriptions and formulas for stock preparations were incredibly complex. There was a special art in keeping each particular drug or preparation in the kind of a container especially suited for its preservation. In Brunfels' *Reformation of Pharmacy* particular attention is given to the description of these details. He states that dry and delicate herbs should be so preserved as to prevent stagnation or a too ready escape of the odoriferous principles with which their medicinal virtues are intimately associated. Moist drugs must be kept in silver, glass, or horn jars. Eye unguents must be preserved in china, whereas marrow, lard, and

like fats may be kept in zinc boxes. Oils are best kept in glass, aromatic spices in gold or silver containers. Theriac, if genuine, he says, is worthy of a golden box, but he adds that one of zinc or lead will answer.

Poppy heads, chamomile, centaury, and similar drugs were often kept suspended in bunches from the ceiling of the store or of the laboratory, which was usually adjacent. In Ryff's book he says "Honey and sugars are the druggist's chief stock in trade. He uses it for his confects, electuaries, preserves, syrups, juleps, and other precious mixtures."

In this same century, in Paris, one of the edicts gave to the pharmacists a monopoly of the sale of gingerbread. This occasioned much controversy, which eventually led to the separation of grocers, spicers, bakers, and confectioners. Some modern pharmacists have gone back to selling gingerbread, but not as a monopoly.

In England pharmacy had been almost entirely divorced from medicine as a practice. King Henry VIII had a lot of trouble on his hands in consequence of this fact. In 1511 an act incorporating the College of Physicians and giving them the exclusive right to practice physic in London and for seven miles around, was intended to suppress the apothecaries, who were encroach-

ing upon the rights of physicians. This organization was conducted upon the orthodox line of supposed Galenic wisdom. It is a matter of record that soon after its incorporation a Dr. Geynes was admitted to fellowship only after he had signed a recantation of his error in having impugned the infallibility of Galen.

In 1542 the act of 1511 was much modified, and in consequence pharmacists became very insolent and aggressive.

A prominent pharmacist and physician of Henry's reign named Bulleyn, who is said to have been a cousin of Anne Boleyn, one of the King's numerous wives, laid down the following rules for the practice of pharmacy:

> The apothecary must first serve God; foresee the end, be cleanly, and pity the poor. His place of dwelling and shop must be cleanly, to please the senses withal. His garden must be at hand with plenty of herbs, seeds, and roots. He must read Dioscorides. He must have his mortars, stills, pots, filters, glasses, boxes, clean and sweat. He must have two places in his shop, one most clean for physic and the base place for chirurgic stuff. He is neither to decrease nor diminish the physician's prescriptions. He is neither to buy nor sell rotten drugs. He must be able to open well a vein, for to help pleurisy. He is to meddle only in his own vocation, and to remember that his office is only to be the physician's cook.

Bulleyn was the author of a *Book of Simples,* noted in his day, which is especially distinguished

for a formula for an electuary of precious stones (*Electuarum de Geminis*). This formula is quoted in full as an example of what the pharmacist of those days might be called upon to prepare:

Take two drachms of white perles; two little peeces of saphyre; jacinthe, corneline, emerauldes, granettes of each an ounce; setwal, the sweat root doronike, the rind of pomecitron, mace, basel seede, of each two drachms; redde corrall, amber, shaving of ivory, of each two drachms; roots of both white and red behen, ginger, long pepper, spicknard, folium indicum, saffron, cardamon, of each one drachm; troches of diarodon, lignum aloes, of each a small handful; cinnamon, galinga, zurubeth, which is a kind of setwal, of each one and one-half drachms; thin peeces of gold and sylver, of each half of scruple; musk, half a drachm.

The electuary was to be made with "honey emblici, which is the fourth kind of mirobalans, with roses, strained, in equal parts as much as will suffice."

Bulleyn adds "Kings and noblemen have used this for their comfort. It causeth them to be bold-spirited, the body to smell well, and ingendereth to the face a good color." A modern pharmacist would need a glossary and a "quid pro quo" list, and would probably charge the price of a Rolls Royce for compounding such a polypharmacal mess. And this was only one of a great number.

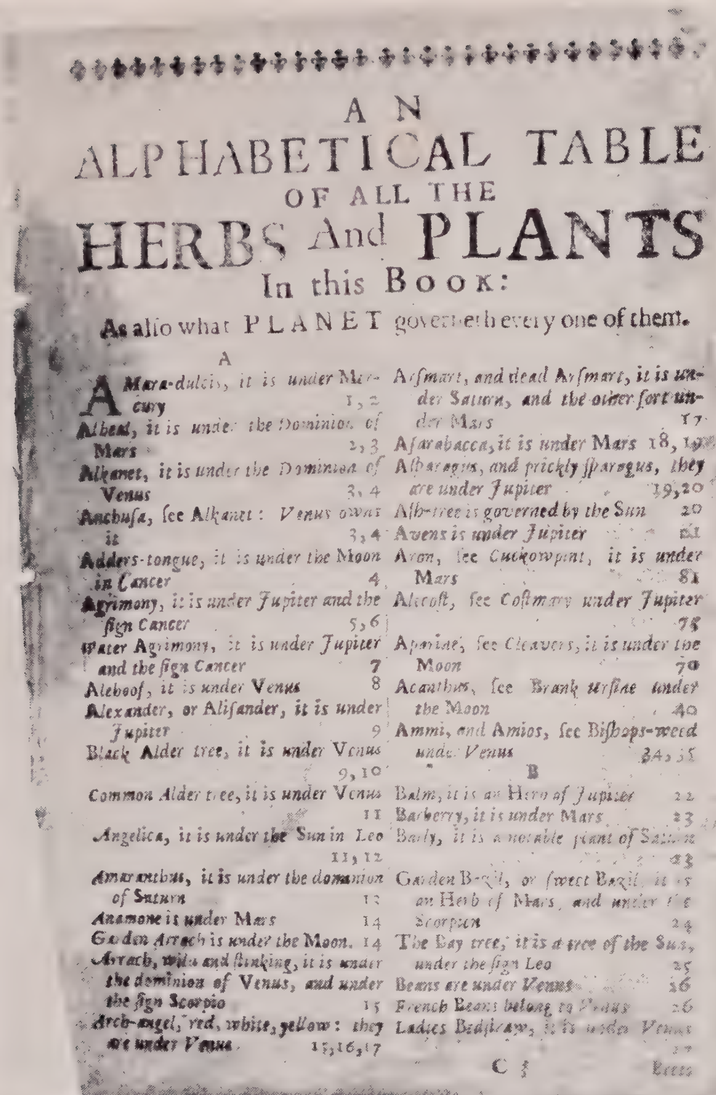
Henry VIII was fond of dabbling in pharmacy himself. One of the English historians, Brewer, says of his reign:

> The Amusements of the court were diversified by hunting and out-of-door sports in the morning; in the afternoon by Memo's music, by the consecration and distribution of "camp rings," or the invention of plasters and the compounding of medicines, an occupation in which the King took unusual pleasure.

In the British Museum are records of some of the pharmaceutical achievements (?) of this monarch. One was called "The King's Majesty's Own Plaster." It contained pearls and guaiacum wood. Another authority says of him: "He was great dabbler in physic, and offered medical advice on all occasions which presented themselves, and also made up the medicines."

I have before me as I write a celebrated antidotary of the sixteenth century. The work is in two columns. The first is devoted to the general principles of pharmacy and medicine. The author's name is John Jacob Wecker; he was professor of pharmacy and medicine at Basle and city physician at Kolmar.

The second volume contains 898 quarto pages of formulas, literally thousands of them. That it is not a one-man book is shown by the names of authorities quoted, for the origin of each formula



AN
ALPHABETICAL TABLE
OF ALL THE
HERBS And PLANTS
In this BOOK:
As also what PLANET governeth every one of them.

A

Amara-dulcis, it is under Mercury 1, 2	Arsmart, and dead Arsmart, it is under Saturn, and the other sort under Mars 17
Albeal, it is under the Dominion of Mars 2, 3	Asarabacca, it is under Mars 18, 19
Alkanet, it is under the Dominion of Venus 3, 4	Asparagus, and prickly sparagus, they are under Jupiter 19, 20
Anchusa, see Alkanet: Venus owns it 3, 4	Ash-tree is governed by the Sun 20
Adders-tongue, it is under the Moon in Cancer 4	Avens is under Jupiter 21
Agrimony, it is under Jupiter and the sign Cancer 5, 6	Aron, see Cuckowpint, it is under Mars 81
Water Agrimony, it is under Jupiter and the sign Cancer 7	Alecost, see Costmary under Jupiter 78
Alehoof, it is under Venus 8	Aparine, see Cleavers, it is under the Moon 70
Alexander, or Alisander, it is under Jupiter 9	Acanthus, see Brank ursine under the Moon 40
Black Alder tree, it is under Venus 9, 10	Ammi, and Amios, see Bishops-weed under Venus 34, 35
Common Alder tree, it is under Venus 11	**B**
Angelica, it is under the Sun in Leo 11, 12	Balm, it is an Herb of Jupiter 22
Amaranthus, it is under the dominion of Saturn 13	Barberry, it is under Mars 23
Anamone it under Mars 14	Barly, it is a notable plant of Saturn 23
Garden Arrach is under the Moon. 14	Garden Bazil, or sweet Bazil, it is an Herb of Mars, and under the Scorpion 24
Arrach, wild and stinking, it is under the dominion of Venus, and under the sign Scorpio 15	The Bay tree, it is a tree of the Sun, under the sign Leo 25
Arch-angel, red, white, yellow: they are under Venus 15, 16, 17	Beans are under Venus 26
	French Beans belong to Venus 26
	Ladies Bedstraw, it is under Venus 27

C 3 Beets

FIG. 25.—PAGE FROM A WORK BY NICHOLAS CULPEPER, 1656, SHOWING THE APPLICATION OF THE DOCTRINE OF SIGNATURES TO PLANTS. SEE PAGE 320.

is stated. There are more than 100 of these authorities. Many of them are names with which we are familiar. Cleopatra stands at the head of the list through some of her recipes for cosmetic preparations, which are given under the authority of Galen. Dioscorides, Galen, Scribonius, Mithridates, Damocrates, Nicholas of Salerno, Nicholas Myrepsus, Mesue, Avicenna, Paul of Aegina, Actuarius, Ætius, Serapion, Alkindus, Alexander of Tralles, Baptista Porta, Gilbertus de Anglicis, Trotula—all the authorities whom we have mentioned in previous chapters besides Paracelsus and Valerius Cordus, who were contemporaries and whose work is still to be considered. This leaves nearly 100 names of authorities who were pharmacists and physicians of the previous centuries, most of whom cannot now even be identified. Truly there must have been an immense accumulation of literature which was just finding its way out of the darkness that had enveloped it up to the days of printing.

And the classes of preparations. What modern pharmacopæia could show a list like this? This list is given in the Latin original form without translation. The study of some of these ancient classes of preparations alone would make a good research subject for some enterprising scholar. The list is as follows: *Aquæ, Syrupi,*

Julepi, Succi, Emulsi, Vini, Decocta, Infusa, Clysteres, Gargarismata, Errhines, Fomentes, Epithermati, Malagmata, Embrochi, Insessiones, Balnei, Lotiones, Olea, Balsami, Pulveres, Electuarii, Opiati, Conservi, Elegmata, Condita, Extracta, Linimenta, Unguenta, Emplastra, Cataplasmata, Cerata, Dropaces, Sinapismata, Ceres Tingendes, Salia, Pilulæ, Confectiones, Trochisci, Collyria, Apophlegmata, Suppositoria, Pesses, and *Sacculæ.* Here are nearly fifty classes of preparations and under many of these are sub-classes—truly a formidable group.

Under some of these classes, especially the *Aquæ, Syrupi,* and *Electuarii,* are scores of complicated preparations, complex both as to their ingredients, for polypharmacy was still rampant, and especially complicated as to their methods of preparation. It is to be noted with interest that the oldest medicated wines are attributed to Dioscorides, and the oldest vinegars to Galen. The word " percolate " is used in this book in connection with a mouth wash which contains the drugs nutmeg, ginger, mastic, pyrethrum, marjoram, hyssop, mint, rosemary, sage, and salt. The drugs are to be mixed with wine and boiled, then transferred to a strainer and " *frequenter percolato.*" Who says that percolation was not mentioned before the nineteenth century?

Some of these preparations are still in use today, notably the oxymel of squill, which is made much the same as we make it now from vinegar of squill and honey. Cold cream is found under the title *Ceratum infrigidans,* and the formula is attributed to Galen. Under the confections is that toothsome almond candy called "marzipan," which name, given as a synonym, is evidently derived from the Latin title *Panis Marsicus.* The modern symbols for the ounce, drachm, and scruple are found in this work and each recipe is preceded by the symbol ℞. (In a contemporaneous work called *Philoni Pharmaceutici* by D. Bertholdorivio, Doctori Philosophico, each recipe is preceded by the sign of Jupiter, ♃.)

In the work of Wecker the word "Laudanum" appears in the title *Laudanum Mercuriale,* which is a preparation made from mercury, vinegar and salt and which is to be administered with Theriaca.

The formula for *Theriaca Andromachi Senioris* in this book is attributed to Galen. The ingredients are given as follows:

℞ Trochiscorum scilliticorum ʒ.xlviij.

Trochiscorum theriacorum, Hedycroi, Piperis longi, Opii ana ʒ.xxiiij.

Rosarum rub. purgataru, Iridis Illyricæ, succi Glycyr-

rhizæ, sem. Napsi sylvestris, Scordii, Opobalsami, Cinnamomi, Agarici ana ʒ.xij.

Myrrhæ, Costi, Croci, Casiæ ligneæ veræ, Nardi Indicæ, Schoenanthi, Thuris electi, Piperis nigri, albi, Dictamni Cretici, Comarum Marrubij, Rhapontici, Stroechadis, sem. Petroselini, Calaminthæ montanæ, Terebinthinæ, Zingiberis, rad. Quinquefolii ana ʒ.vj.

Polii montani, Chamæpityos, Styracis calamitæ, Meu, Amomi, Nardi Celticæ, Terræ Lemniæ, Phu, Chamædryos, Folii, Chalcitidis tostæ, Gentianæ, Anisi torrefacti, succi Hypocitidis, Carpobalsami, Gummi Arabici splendidi, sem. Foeniculi, Cardamomi, Seseli, Acaciæ, Thlaspi, Hyperici, Ammi, Sagapeni, Acori ana ʒ.iiij.

Castorii, Aristolochiæ tenuis, sem. Dauci Cretici (Pimpinellæ nostræ), Bituminis Judaici, Opopanacis, Centaurii minoris, Galbani ana ʒ.ij.

Mellis despumati lb.xiiij.℥.v.ʒ.ij.

Vini optimi odorati quantum satis est.

Conficitur autem hoc modo secundum Galenum.

The compounding directions occupy an entire quarto page of the book. All of the other famous confections and electuaries are also given in full detail in this work.

The sixteenth century was the one in which the theriacs made their last stand in the original complicated form. Being believed by many physicians to be specific against plague there was a great and universal demand for them. The public manufacture, as described in the history of the previous century was more widespread than

ever. In Bologna the compounding was done in the courtyard of the City Hall and in the presence of the city officials and qualified inspectors. The Theriac of Venice (Venice Treacle, as it came to be called) acquired a supremacy over the theriacs as made by the rival cities of Genoa, Florence, and Bologna, and even of faraway Constantinople or Cairo.

It contained 61 ingredients and its manufacture was the occasion of much pomp and ceremony. John Evelyn, whose travel memoirs are almost as celebrated as those of Marco Polo or John Mandeville, or of the diary of his contemporary Pepys, states in connection with an account of a visit to Venice: "Having packed up my purchases of books, pictures, casts, treacle (the making and extraordinary ceremony whereof I had been curious to observe, for it is extremely pompous and worth seeing), I departed from Venice."

In Queen Elizabeth's reign the English apothecaries seem to have been making theriac of their own, which they claimed was superior to the imported product. A controversy had evidently occurred, for Hugh Morgan, Apothecary to the Queen, issued a pamphlet in 1585 in which he emphatically states that his product had been compared with other "theriacle"

brought from Constantinople and from Venice, and had received commendation. He goes on to say: "It is very lamentable to consider that strangers do dayly send into England a false and naughty kind of mithridatum and threacle in great barrelles more than a thousand weight in a year and utter the same at a low price for 3 pence and 4 pence a pound to the great hurt of her Majesties' subjects and no small gain to the strangers' purses."

Cairo also had a reputation for very fine theriac. Prosper Alpinus, a physician of Padua, who resided three years in Cairo, gives a graphic account of the ceremony of its preparation in that city. It occurred annually in May in the Mosque of Moreston, under the supervision of the city's chief pharmacist in the presence of all the physicians. At that time purchasers from many European countries visited Cairo for their supplies of theriac. "Tyriaca," as he called it, will be remembered as having been recommended by the Patriarch of Jerusalem, Helias, to Alfred the Great in the tenth century, or 500 years previously, and it was probably the theriac of Cairo of which he spoke so glowingly.

While we are about it we may as well follow theriac into the next century and complete its story. A celebrated theriac of the seventeenth

century was that invented by Sir Walter Raleigh while undergoing imprisonment in the Tower during the reign of James I. It consisted of 40 seeds, herbs, barks, and woods macerated in alcohol, distilled, and the distillate subsequently combined with a great variety of mineral and animal ingredients. This preparation was adopted in the London Pharmacopœia under the name of *Confectio Raleighana.* Later the name was changed to *Confectio Cardiaca* and the formula was somewhat simplified. Still later it was further simplified and the name changed to *Confectio Aromatica.* A vestigial remnant of the preparation still remains in the pharmacopœias of our own time under the name of Aromatic Chalk Powder. *Sic transit gloria electuarii.* Such are the vicissitudes and changes that the names and formulas of medicines undergo during the passing years.

A celebrated historian of the subject of theriac in the eighteenth century was Dr. William Heberden, a leading physician of London in his day and a friend of the noted Dr. Samuel Johnson. Garrison says that " Heberden did a most important service to therapeutics by dispelling current superstitions about these curious concoctions and banishing them forever from the pharmacopœia. This little book is one of the shining monuments

of medical scholarship." Even in the late seventeenth century complicated formulas for theriacs were given in some of the privately issued pharmacopœias. (See illustration No. 38 p. 336.)

Medical men who have studied the formulas of all of the theriacs recorded report that the best that can be said of them is that the balsamic constituents might have a slight antiseptic effect upon the alimentary tract, but that the preparations could have no real remedial value in any but imaginary affections, and certainly no antidotal value in case of poisoning, nor any bactericidal property. It is quite probable that the real popularity of the theraics, and possibly some of the reputed therapeutic value, was due to the fact that they were usually taken with wine.

For an interesting description of the store, the laboratory, the stock, the library, the working force, and the daily routine of the sixteenth century pharmacy, the reader is referred to *The Follies of Science* by H. Carrington Bolton.

In France during the sixteenth century the disputes between the physicians and the apothecaries reached such a serious point that the physicians wrote prescriptions for only simple remedies, which could be supplied by herbalists, and when the pharmacists were willing to make

TRACTATUS
DE
NATURA SALIUM.
SIVE

Dilucida deſcriptio, perfecta explanatione declarans naturam, proprietates, & uſus ſalium vulgò notorum, ut & alius cujuſdam, admòdum mirabilis, & hactenus mundo ignoti ſalis, cujus adjumento omnia Vegetabilia, Animalia, & Mineralia, ſine ponderum ſuorum diminutione, & formarum mutatione in dura, & incombuſtibilia corpora tranſmutari poſſunt:

CUM

Demonſtratione firmiſſima, quod ſal (poſt Deum & Solem,) unicum ſit principium, ſolaque origo, propagatio atque augmentum unicum cunctarum rerum, ex quo maximus totius Mundi theſaurus, & maximæ divitiæ erui queant.

ITEM

Tractatulus parvus, & compendioſus de Salium, Metallorum, & Planetarum ſignaturâ.

In Dei omnipotentis honorem & gloriam, Luminiſque Naturæ amplificandi, & declarandi cauſa deſcriptus & in lucem editus operâ & ſtudio

RUDOLPHI GLAUBERI.

AMSTERODAMI,

Apud IOANNEM JANSSONIUM

ANNO MDCLI.

FIG. 26.—TITLE-PAGE OF A BOOK BY JOHN RUDOLPH GLAUBER, 1659. SEE PAGE 288.

terms the physicians compelled each apothecary to take the following oath:

I swear and promise before God, the Author and Creator of all things, One in Spirit and divided in Three Persons, eternally blessed, that I will observe strictly the following articles:

First. I promise to live and die in the Christian faith.

Second. To love and honor my parents to the utmost; also, to honor, respect and render service, not only to the medical doctors who have imparted to me the precepts of pharmacy, but also to my teachers and masters from whom I have learned my trade.

Third. Not to slander any of my ancient teachers or masters, whoever they may be; also, to do all I can for the honor, glory and majesty of physic.

Fourth. Never to teach to ungrateful persons or fools the secrets and mysteries of the trade; never to do anything rashly without the advice of a physician, or from the sole desire of gain; never to give any medicine or purge to invalids afflicted with acute disease without first consulting one of the faculty.

Fifth. Never to examine women privately, unless by great necessity, or to apply to them some necessary remedy; never to divulge the secrets confided to me.

Sixth. Never to administer poisons, nor recommend their administration, even to our greatest enemies, nor to give drinks to produce abortion, without the advice of a physician, also to execute accurately their prescriptions, without adding or diminishing anything contained in them, that they may in every respect be prepared "secundum artem."

Seventh. Never to use any succedaneum or substitute

without the advice of others wiser than myself; to disown and shun as a pestilence the scandalous and pernicious practices of quacks, empirics and alchymists, which exist to the great shame of the magistrates who tolerate them.

Lastly. To give aid and assistance indiscriminately to all who employ me, and to keep no stale or bad drugs in my shop. May God continue to bless me so long as I continue to obey these things.

It was in France also that one of the memorials concluded with the statement that "Although the apothecary is always a grocer, the grocer is not necessarily an apothecary."

In Germany the physicians evidently had some influence with the Emperor Charles V, for in 1548 he decreed that:

It having come to our ears that deteriorated and spurious drugs are being dispensed on physicians' prescriptions, which, if taken into the system will do more harm than good, we do herewith decree, that it is our will that the authorities in matters pertaining to the apothecaries' trade should annually visit and inspect their shops, and also fix the values of all materials there found so that the buyers shall in no way be deceived.

Not long after this decree the druggists of Nuremberg retaliated with the following protest which was submitted as a memorial to the authorities:

May it please the Honorable Council to lend ear to our complaints, and in conformity therewith to see fit, in such

a manner, to protect our interests, that henceforth we shall not be unduly oppressed by the physicians, and that each of us shall be enabled to enjoy the just fruits of his labors. The following, honorable sirs, forms the substance of our complaint:

1. The sale of all confections, formerly dispensed by us, has now fallen into the hands of the sugar dealer.

2. Counter sales are now made by all the large spice and cheap corner grocery shops, thus robbing the druggist of a source of profit that he is justly entitled to.

3. The sale of sundries, such as sealing wax, fumigating pastilles, paper, ink, and pens, is now taking place in common huckster shops.

4. The sugar dealers are not only selling confections but also all kinds of fruit juices, electuaries of quinces, and all such preserves that do not deteriorate in the course of a year.

5. All distilled waters, oils, and the like, which were formerly kept by druggists only, are now indiscriminately sold by any ignoramus who imagines himself qualified to engage in this traffic.

6. Unguenta and Emplastra, which certainly belong to the exclusive field of pharmacy, are now dispensed by barbers and ignorant physicians, who are neither justified by precedent nor by qualification to handle these things.

7. Now, many expensive *medicamenta* are, every year, carried over and deteriorate, because the doctors do not prescribe them, and they prove a total loss to the druggist. Of such medicines we will but enumerate the fruit juices, the purging elixir of roses, etc.; furthermore, the *electuaria, solutiva, tam in liquida, quam in solida forma,* and the *massa pilularum et trochiscorum genera.*

We are pained to learn that the physicians have charged us with selling adulterated and injurious drugs, and declare that the public had on this account withdrawn its patronage from us. Self preservation and honor demand that we no longer remain quiet under these accusations. Albeit, there may be persons who do not wish to deal with us, there are, nevertheless, numbers that prefer to be treated by us, and if we deny them the succor asked for, and send them to the physician, they will be displeased and go without any treatment whatever. This much, also, is certain, that if we would dispense medicines in all cases where we are called upon to prescribe, we would shortly have more patients than the physicians. We have, furthermore, abundant proof that the physicians frequently overstep the boundary line of *their* field. They, for instance, prescribe in German, so that any barber or old woman can prepare the medicine, and the druggist is ignored.

This controversy probably resulted in a drawn battle for we hear of no more charges and countercharges at this particular time.

In 1565 there was an accidental discovery of a peculiar kind of clay at Nevers by the Duke of that province. He procured expert Italian labor and started the manufacture of the distinctive majolica ware. Many famous sets of pharmaceutical shop furniture came from this factory. There were two types, one known as Nevers Art Ware, the other known as Persian Ware. Nevers Ware has always been difficult to identify because, unlike much of the pottery of that period,

it never bears the mark of its origin or the date, merely showing the mark of the individual potter who had formed it. Many of these pieces were in ornamental urn-like shapes, decorated in gold and colors.

Apropos of the conditions in pharmacy in Germany, an etching in the Germanic Museum, dated 1565, shows a fifteenth century pharmacist named Cyriacus Schnaus, kneeling on his mortar absorbed in offering fervent prayer. Several of the German herbals show woodcuts of similar subjects. The custom was probably derived from the monastery apothecaries.

In Belgium it had become necessary to limit the number who might practice pharmacy and to require certain qualifications from those who sought this privilege. An act was passed requiring that before opening an apothecary shop the applicant should have studied pharmacy for three years and must be able to pass examinations in both theoretical and practical branches besides taking the oath of conformity to the Guild.

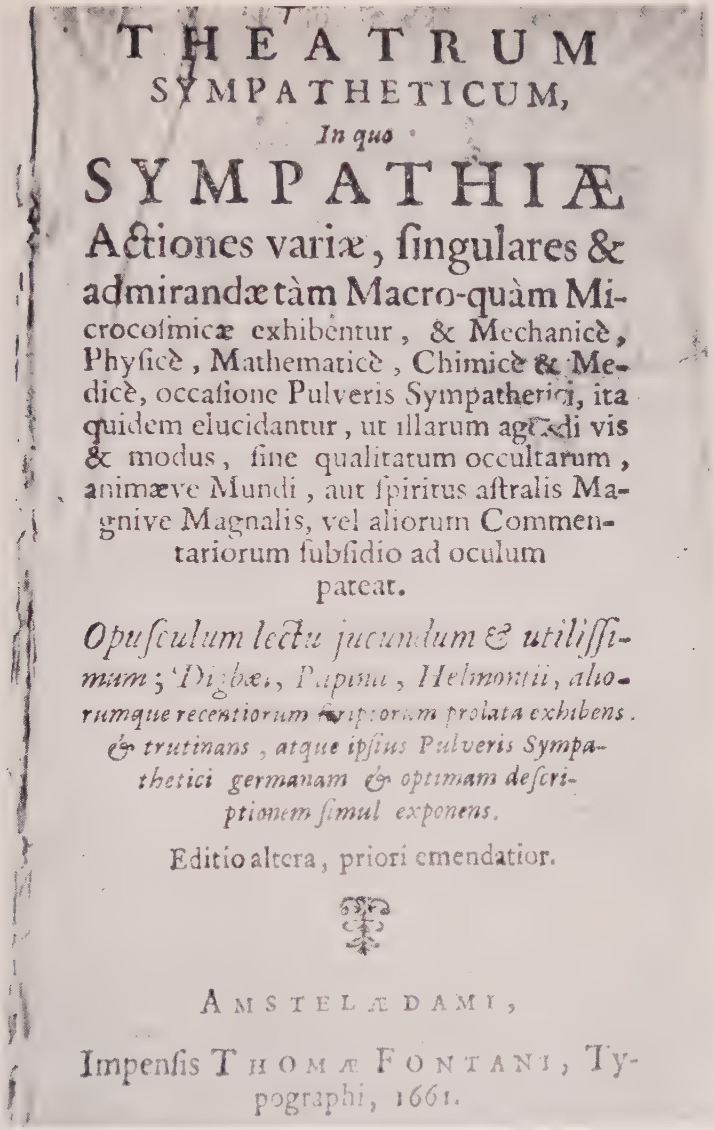
A little later, in Bruges, medical practitioners were forbidden to make or dispense medicines under heavy penalty. The pharmacies had been subject to inspection in Bruges since before the beginning of the sixteenth century.

Poison laws originated both in France and

England during the sixteenth century. In 1531 a law was passed in England making murder by poison high treason. The punishment for this crime was death by boiling in oil. In 1557 another law was passed in the same country called the "Grocers' and Apothecaries' Act," which permitted no poison to be sold unless the seller was assured of the honesty and well dealing of the purchaser. The seller was required to question the purchaser as to the purpose and to make a note of the "byers name and time of bying," unless the buyer presents a note from a discreet physician, which note was to be kept as evidence in case of necessity. This matter will be discussed at greater length in connection with the wave of criminal poisoning which occurred in the seventeenth century.

During the latter part of the fifteenth century and the whole of the sixteenth, privately printed formularies or antidotaries appeared in great numbers. These were either miscellaneous collections, the choice of some particular compiler or author, like that of Wecker previously quoted, or they were reproductions of the works of the ancient authors, frequently with annotations or comments by an author contemporaneous with the time of publication.

I have before me a folio volume which is a



THEATRUM
SYMPATHETICUM,
In quo
SYMPATHIÆ
Actiones variæ, ſingulares & admirandæ tàm Macro-quàm Microcoſmicæ exhibentur, & Mechanicè, Phyſicè, Mathematicè, Chimicè & Medicè, occaſione Pulveris Sympathetici, ita quidem elucidantur, ut illarum agendi vis & modus, ſine qualitatum occultarum, animæve Mundi, aut ſpiritus aſtralis Magnive Magnalis, vel aliorum Commentariorum ſubſidio ad oculum pateat.

Opuſculum lectu jucundum & utiliſſimum; Digbæi, Papini, Helmontii, aliorumque recentiorum ſcriptorum prolata exhibens, & trutinans, atque ipſius Pulveris Sympathetici germanam & optimam deſcriptionem ſimul exponens.

Editio altera, priori emendatior.

AMSTELÆDAMI,

Impenſis THOMÆ FONTANI, Typographi, 1661.

FIG. 27.—TITLE-PAGE OF A WORK ON SYMPATHETIC REMEDIES BY DIGBY, PAPIN, VON HELMONT, AND OTHERS. SEE PAGE 324.

rather remarkable example of sixteenth century compilation. It contains the complete pharmaceutical works of Mesue in Latin form, with annotations and comments by Jacob Sylvius, John Monardus and Andrea Marinus. There is also present in the same volume the *Antidotarium Parvum* of Nicholas Præpositus, and the Formularies or selections from the pharmaceutical works of the following authors in addition: Christophorus de Honestis, Peter Abano, Franciscus de Piedmontanus, Platearius, Johannes de Sancto Amando, Gentilis Fuliginatus, the *Liber Servitorius* of Albucasis, Saladin of Æsculanus, Alkindi, and a complete compilation of the " Succedanea " of ancient authors, and also a complete list of synonyms. Surely this must have been a much-sought-for and widely-used book in its time.

Another formulary which appeared in the sixteenth century and is sometimes quoted is that of Jean de Vigo, physician to Pope Julius II. Still another is that of Jacques Dubois or Leboë, who Latinized his name to Jacobus Sylvius. He became quite a commentator and editor of the works of others.

Matthiolus was a commentator on the works of Dioscorides, as was also Ruellius of this same century. Fallopius, the physician, discoverer of

the Fallopian tubes, was a dabbler in pharmacy. I have a book of his published in 1570 of which the title page (translated) reads as follows:

> Diverse and miraculous secrets.
>
> Newly reprinted for the common benefit of all—in three volumes.
>
> 1. The qualities, content, and mode of preparing diverse oils, cerates, ointments, unctions, electuaries, pills and many other medicaments.
> 2. The standards and methods of production of diverse sorts of wines and health giving waters.
> 3. The sometimes prohibited, most important secrets of alchemy, and other delightful and curious secrets.
>
> collected by
>
> Fallopius
>
> and approved by physicians of great fame
>
> with privilege
>
> Venice—1570.
>
> Printed by Vincenso Valgrisi.

Under the name of Josephus Quercetanus, a Frenchman named Joseph du Chesne wrote and edited many pharmaceutical works and formularies in the sixteenth century. He was a widely quoted authority in the seventeenth and eighteenth centuries. Another author named Quercetanus also was known. He will be referred to later.

The flood of formularies had one important effect. It awakened the consciousness of a need for something authoritative which should officially

serve for a community. The City of Nuremberg, through its Senate, was one of the first communities to satisfy this need in a legislative enactment. In 1529 this body enacted a law which reads as follows: "All the *Laxativa* such as *Electuaria* and *Pilulæ* must be prepared and dispensed by the druggists in accordance with the directions in the book known as the *Luminare Majus.* To avoid any error or oversight in the preparation of these *Laxativa* and to ensure even preparations by all druggists, these *Laxativa* have been carefully copied from the *Luminare Majus* by the Doctors of Medicine. Each druggist will be furnished with a copy, by which he must be guided, to the exclusion of all other formulas."

The *Luminare Majus* mentioned in this law was a receipt book compiled from Greek and Arabic sources by Jacobus Manlius de Bosco in Venice in 1406. There was also a *Luminare Minus* or *Lumen Apothecariorum* which Quirinus de Augustus de Thertona had compiled and published in Venice in 1494. The former did not altogether meet the needs of the situation for it was more than one hundred years old.

The time had come for something better, and Nuremberg was to supply it. On February 18, 1515, there was born in Simtshausen in Hesse, a boy who was named Valerius Cordus by his father

Enricius Cordus, who was professor of medicine at Marburg. Valerius was somewhat of a prodigy and was graduated from Marburg with the baccalaureate degree at the age of 16. He then went to Wittenberg, where he taught for twelve years. Finally he went to Italy to study and died at Rome in 1544 at the early age of twenty-nine.

He was suspected of being a heretic, and the authorities were about to throw his body into the Tiber, when it was seized by two of his countrymen and carried away. His death was lamented in these lines:

> "Ingenio superest Cordus; mens ipsa recepta est
> Cœlo; quod terræ est, maxima Roma tenet."

Valerius Cordus had always been interested in collecting and improving pharmaceutical formulas, and during the twelve years of his teaching at Wittenberg had spent much time on this work. Pharmacists in Saxony had heard of his compilation and had come to him for formulas, which he furnished in manuscript form, as he had not thought of printing them. On his way to Italy he stopped off at Nuremberg. The fame of his pharmaceutical formulary research having preceded him, the physicians of Nuremberg asked Cordus to furnish a copy for the local druggists. Cordus, wishing to have the official sanction of

the Senate for such a proceeding turned over his complete manuscript to that body for examination and approval. The Senate tentatively accepted it with thanks and turned it over to a local committee of physicians for investigation.

The committee soon reported that in their opinion it was the most complete work of its kind they had ever seen and required no alterations or corrections. The Senate immediately ordered it printed and upon its appearance, which was in 1546, two years after its author's death, directed all druggists to prepare their medicines according to its formulas. Thus appeared the first authoritative work of the pharmacopœia type, especially printed and authorized for use in a community for the sake of uniformity.

The complete title of this work was *Pharmacorum Conficiendorum Ratio, Vulgo Vocant Dispensatorium.* (See illustration No. 12 p. 92.) As will be seen by this title the work was really called a dispensatory. Its author had favored the Greeks, Romans, and Arabians in the selection of his formulas. He quotes Dioscorides, Galen, Andromachus, Rhazes, Avicenna, Mesue, Nicholas Præpositus, and many others.

Cordus' book contained comparatively few classes of preparations. They were divided into Aromatics, Opiates, Confections, Conserves, Pur-

ges, Pills, Syrups, Electuaries, Plasters, Cerates, Troches, Salves, and Oils. It created a widespread sensation outside of Nuremberg and was in such immediate and continuous demand that many other editions were published in Paris, Lyons, Venice, and Antwerp. It held its place until 1666 and was revised five times during the intervening period. However, the work of Valerius Cordus stimulated the production of local pharmacopœias in other cities.

When one first sees a copy of a sixteenth century edition of Valerius Cordus one is astonished and disappointed at its small size. An edition published in 1561, which I have before me, could easily be slipped into a side coat pocket, as it is a small 16mo volume. When it is opened, and its formulas studied it is rather shocking to see the dozens of nauseous polypharmacal messes which are included. If the physicians and Senate of Nuremberg were so favorably impressed with the superiority of this work one cannot but wonder what must have been the character of the formulas that had previously been used. This work may mark a pharmaceutical epoch, but as a pharmacopœia it is a great disappointment, as any one will agree who closely examines it.

In 1560 appeared a new Florentine Formulary, and also the *Antwerp Pharmacopœia,* and

in 1564 the *Pharmacopœia Augustana* of Augsburg; in 1565 the *Pharmacopœia Coloniensis* of Cologne; in 1559 the *Pharmacopœia Mantissæ* of Mantua, Italy; in 1561 the *Pharmacopœia Basiliensis* of Basle, Switzerland; in 1574 Jacobus Sylvius published a pharmacopœia which was widely used in France; in 1580 the *Pharmacopœia Bergami* of Bergamo, Italy, appeared; and in 1588 the *Pharmacopœia Salamanca* of Salamanca, Spain.

This was the century of the appearance of a number of noted herbals or illustrated works on botany. Of the important ones there were Bancke (1525), Treveris (1526), Carey (1550), Turner (1551), Bock (1551), Fuchs (1552), Matthiolus (1565), and Gerarde (1597). These were all printed in English. Many of the great botanic gardens were instituted during the sixteenth century, primarily for growing and studying medicinal plants. Among these were Padua (1533), Florence (1544), Bologna (1547), Paris (1570), and Montpellier (1598).

It was also the century of the first great epidemic of syphilis, which the inhabitants of each nation tried to blame on the other, for the Spanish called it the French disease, the Italians called it the Spanish disease, the French called it the Neapolitan disease, and so on *ad infinitum*.

Tobacco had first been introduced into Europe in 1559 by Jean Nicot, ambassador to Lisbon for Francis II of France. It is Nicot whose name is perpetuated in the generic name of the plant, *Nicotiana,* and in the name of its principal alkaloid, nicotine. It was looked upon as one of the wonders of the new world, possessed of many virtues. It was known by the name of *Petus* in the early herbals. Nicot is said to have carried seed of this plant to Catharine de' Medici. Perhaps the infusion of tobacco was one of the poisonous potions of this famous character.

While all of this pharmaceutical development which has engaged our attention was going on, other important things were happening in this great world. The early part of the century saw Raphael, Michael Angelo, Titian, Holbein, and Correggio, the artists; Luther, Melancthon, Erasmus, Xavier, Loyola, Calvin, and Knox, the ecclesiastics; Thomas More, Hans Sachs, Ariosto, Rabelais, Montaigne, Tasso, and Spenser, the authors and poets; Palestrina the musician, and Vesalius the anatomist.

This was the century which included the greater part of what is called the Elizabethan Era. In 1558 Calais was lost to England, and in that same year Elizabeth, the Virgin Queen, ascended the throne. In 1567 James VI became King of

Scotland, and the following year Mary, Queen of Scots, was imprisoned and later executed. In 1570 Elizabeth was excommunicated by the Pope as a heretic. In the following year the Levant Company was chartered and the trade in drugs direct from the Orient to England increased. In 1585 Raleigh's first and unsuccessful attempt to colonize Virginia was made. In 1588 the Spanish Armada was destroyed.

Queen Elizabeth was an amateur dabbler in pharmacy, as had also been her royal father and predecessor. A formula devised by her as a cephalic-cardiac medicine, and sent to the Holy Roman Emperor, Rudolph II, contained amber, musk, and civet dissolved in spirit of roses. This would certainly render the patient rather odoriferous. The Queen's apothecary, Hugh Morgan, had a good customer in Elizabeth, for the records show that in a single quarter she paid him over £80 (equivalent to $400), for confections, sweetmeats, conserves, and perfumes.

In this famous century, too, the ships of Magellan and of Sir Francis Drake circumnavigated the globe. Portugal, which had wrested the drug and spice trade of the world from Venice, through the reaching of the Orient by sea by way of the Cape of Good Hope, had to contest with Spain for the commerce she had built up, and

both Spain and Portugal were fought by Holland and by England for the control of the world's richest commercial prize at that time, the supplying of drugs and spices to Northern Europe.

In general science the world was made safe for astronomy by a Polish monk named Koppernigk, whose name has been Latinized as Nicholas Copernicus. Copernicus was born in 1473. He studied the stars in Bologna in 1493 and obtained a degree in chemistry at Padua in 1498. He then taught chemistry and mathematics at Rome. His advanced views as a science teacher attracted the attention of the authorities who felt that he would better be curbed. Instead of censuring him, however, the Pope gave him an appointment as Canon of Frauenberg in Poland. This was a small sleepy village where he might expound his advanced views as much as he liked, for nobody would be able to understand him. Copernicus was bewildered; he had a sincere fear and reverence for the church, which, in his simplicity, he thought would welcome the truth, even if it did not entirely agree with some of the minor points of the orthodox faith, for had he not heard those debated among the Cardinals themselves?

Copernicus must have had a superabundance of energy, a wonderful brain, and marked mechanical ability. Deprived of the stimulating

contact with young minds eager to learn, he devoted his thought and his energy to creative work. In his spare moments he invented or developed the mathematical science of trigonometry, he devised a quadrant and a surveying rod, he painted pictures, he developed a system of sanitation for his village, including a sewage system and a water supply, for which he obtained the pressure by making a water tank of his church belfry.

He advised the King of Poland concerning the coinage of his realm and wrote a book on the subject which is still a classic. These works covered a period of many years, but during all of his other activities he was continually studying the planets and the stars and making notes of their changes in position. He had been taught the Ptolemaic astronomy which assumed that the earth was the centre of the universe, the geocentric theory, as it is called. He had convinced himself of its fallacy and had accumulated proofs in favor of the theory that the sun was the centre of our solar system, the heliocentric theory.

He was now ready to give these proofs to the world, which he assumed would eagerly receive them. For years longer he worked upon his precious manuscript. He was aging rapidly. At last the great work was finished. Where should he publish it? He had an intuitive feeling that

the Church might not approve if he asked permission of the Pope. "Cum privilegio" is the imprint upon many of the books published in the sixteenth and seventeenth centuries. This was a precaution which would insure that the book would not fall under the ban and be placed on the *Index Librorum Prohibitorum.* Copernicus was afraid to ask for the privilege. He had a friend in the Church, a Cardinal, whose advice he sought.

The Cardinal was a broad-minded, generous soul, who not only lent Copernicus the money to publish the book, for printing and paper were expensive, even at that time, but he took the wonderful manuscript to Nuremberg, known as the free city, where were to be found printers who did not insist upon permission of the Church for publication. Copernicus showed his loyalty to the Church, in spite of his fear of its censure of his work, by dedicating the volume to the Pope. At last, in 1542, the volume was printed. It was called *De Revolutionibus Orbium Celestium,* and it gave to the world its first clear conception of the solar system.

Copernicus was an old man of 70 and was ill—he was on his death bed. He eagerly desired to see the book before he died. Nuremberg was a

FIG. 28. — ILLUSTRATION OF A SEVENTEENTH CENTURY PHARMACEUTICAL LABORATORY. FROM PETERS *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 296.

long distance from Frauenberg. A special messenger was dispatched with a copy of the volume, which was placed in the hands of the dying man for him to feel, just as his life passed out of his body.

The book was at first acclaimed by the authorities, but as soon as some of the educated men of the Church had read it and had seen how vitally it disagreed with the orthodox teachings of the Church, it was quickly repudiated and placed upon the *Index*. Here it remained for nearly 200 years, the ban being removed early in the nineteenth century, after it had served as the basis for many controversies, and the torture, imprisonment or death of those who believed in or taught its doctrines.

Other astronomers followed Copernicus in the sixteenth century. One of these was Tycho Brahe, a famous Dane, better known to fame as the man with the silver nose. His nose having been cut off in a duel was cleverly replaced with one of metal, which was cemented in place. Brahe made several important astronomical discoveries. He was an alchemist and an occultist, believed in astrology, and was superstitious to an extreme degree. He devoted much time to opposing the views of Copernicus, and was one of the motley

group of scientists and charlatans attracted to Prague by Rudolph II of Bohemia, concerning whom we shall hear later.

John Kepler, who was also at Prague when Brahe was there was a German astronomer and a pupil of Brahe. He saw the fallacy of his master's views, and being converted to the Copernician theory, published a popular exposition of it, which was immediately placed upon the *Index* also. Kepler wrote his most famous astronomical works while at Prague and is celebrated as the author of an important work on mensuration and of certain mathematical formulas concerning astronomy, which are still used and known as Kepler's laws.

The grim finale to this sixteenth century astronomical drama was the punishment by the Church of Giordano Bruno, a Dominican monk who taught the Copernican theory and who was burned at the stake on February 7, 1600, for this offense against the Church. Bruno the martyr was a philosopher, poet, and mystic who "swept the intellectual heavens of Europe like a brilliant meteor." He became disgusted with conditions as encountered in the Church, as had Luther, who had effected the Reformation in this same century, but unlike Luther, he was a scientist with an

impelling desire to teach the truth. He arraigned in strong satire the stupidity, rascality, and hypocrisy which were then prevalent, laying aside the habit of his order and wandering from city to city. He studied in Lyons and received the doctorate degree. He then went successively to Paris, Oxford, Wittenberg, Prague, Frankfort, Zurich, and Venice, teaching in all of these places the Copernican doctrine that the sun is the centre of the solar system. He was apprehended by the Church, incarcerated, questioned by the Roman Inquisition, and being convicted of heresy was executed by being burned at the stake in the presence of Pope Clement VIII and prelates, cardinals, and pilgrims assembled from all parts of Italy.

On June 9, 1889, many men from many lands unveiled a monument to Giordano Bruno on the spot where he was sacrificed to science.

Another brilliant intellectual luminary swept over the first half of the sixteenth century. This time it illuminated pharmacy and medicine in particular. It was that daring soul who called himself Paracelsus, and whom Browning attempted to explain later in his poem of that name. Paracelsus was born at Einseideln, Switzerland, on November 10, 1493. His father was a physi-

cian named William Bombast von Hohenheim, who christened the boy Theophrastus, after a disciple of Aristotle, of whose teachings he was an admirer. The son is sometimes called Philippus Aureolus Theophrastus Bombastus von Hohenheim. His mother had been a hospital matron before her marriage, so he had a favorable heredity for his development along medical lines.

His mother died when he was young, but his father looked after both his bodily and intellectual development and taught him the rudiments of alchemy, pharmacy, surgery, and medicine. At the age of sixteen he was sent to the University of Basle and it was here that he adopted the cognomen of Paracelsus, probably having as his ambition the goal of becoming more learned than Celsus, the famous Roman physician who was still considered an authority after 1500 years. He later visited Würzburg, where he developed his strain of occultism by studying magic under Johannes Trithemius, Abbot of Spanheim.

While here he also studied the Bible, for the Abbot was a devout student of that book, as well as of magic. In 1513 he spent some time working in the silver mines and laboratories at Schwartz and devoted much time to alchemy. Here he wrote his first work, called *Archidoxa.*

Paracelsus is an enigma to modern medical, chemical, and pharmaceutical historians, for he possessed none of the qualities that are usually demanded of a leader. He is described as uncouth, boorish, maudlin, vain, ignorant, and pretentious. Some of these adjectives certainly must be misplaced, and it would seem rather that he was one of those untamed, restless, roving souls, caring nothing for sham and with an uncontrollable urge to reform everything that he encountered.

At the age of twenty-three he was wearied of the stilted forms and dead scholasticism of the schools, so he went forth to roam and study in the great university of nature. He spent the next nine years as a pilgrim of the world, seeking truth wherever it might be found. He writes during this period "A doctor must be a traveler because he must enquire of the world. Experiment is not sufficient. Experience must verify what can be accepted or not accepted. Knowledge is experience."

What a shock that must have been to the hard-boiled worshipers of tradition. We can scarcely conceive of the entrenched power of the past that existed in science, although the Renaissance in art, architecture, and literature was well along the

road to safety. We can partly grasp the idea when we read of this period that Massaria, a learned professor of Pavia, absolutely declared that he would rather err with Galen than be right with any other physician.

Paracelsus next wrote: "A doctor cannot become efficient at the universities. How is it possible in three or four years to understand nature, astronomy, alchemy or physic?" He despised the methods of the orthodox physicians so he "determined to abandon such a miserable art and seek truth by some other way." He visited Vienna, Cologne, Paris, Montpellier, Bologna, Padua, Ferrara, Granada, and Lisbon. Here he embarked for England, from whence he journeyed successively to Holland, Denmark, Sweden, Prussia, Bohemia, Poland, Transylvania, Wallachia, and Croatia.

He then went to Venice by way of Trieste, later he crossed the Balkans and visited Russia, going from here to Constantinople, where he arrived in 1521. On this journey he is said at one time to have been captured by the Tartars, and was for a while a favorite at the court of the Grand Khan of that empire.

He gathered knowledge from the highest and lowest sources, for in his years of wandering he

not only consulted physicians and alchemists, but sought out peddlers, gypsies, fortune tellers, mendicant monks, and even ordinary beggars.

In Constantinople he is said to have found the philosopher's stone, the search for which he later condemned. After leaving Venice he became an army surgeon under Charles V, Emperor of Germany, who was at war with Francis I, King of France. He became renowned as a healer everywhere he went, and traveled again through Bohemia, Poland, and Slavonia, where his methods were opposed by, and his successes made him enemies among, the orthodox practitioners of medicine. He says, of this and later periods "I pleased no one except the sick whom I healed."

In 1526 he settled in Wurtemberg as a practicing physician and surgeon, and gathered about him a group of young student disciples. He was bitterly opposed by the regular practitioners because his treatment of disease was simple and he did not prescribe the nauseous and expensive electuaries. He said bitterly, "the physician's duty is to heal the sick, not enrich the apothecaries."

Time after time he settled down and gathered about him a group of young enthusiasts, and time after time he was compelled to flee, his very life

being sometimes threatened. He finally went to Basle where he was appointed professor of medicine at the University. Here he initiated his course of lectures by publicly burning the works of Galen, Hippocrates, Avicenna, and many others of the older authorities, in order that "all misery might be carried away in their smoke," and by lecturing in German instead of in Latin, which had been the usage for all science teaching.

"Follow me," he cried, "not I you, Avicenna, Galen, Rhazes, Montagnand, Mesue, and ye others. Ye of Paris, of Montpellier, of Swabia, of Cologne, of Vienna; from the banks of the Danube, of the Rhine, from the islands of the seas, from Italy, Dalmatia, Sarmatia and Athens; Greeks, Arabs, Israelites, I shall be the monarch and mine shall be the monarchy."

Browning makes Paracelsus say:

"I think my class will not forget the day
I let them know the gods of Israel;
Ætius, Oribasius, Galen, Rhazes,
Serapion, Avicenna, Averrhoes
Were blocks."

and

"That yellow, blear-eyed wretch in chief
To whom the rest cringe low with feigned respect,
Galen of Pergamos."

FIG. 29.—ILLUSTRATION OF THE SEVENTEENTH CENTURY COURT PHARMACY AT RASTATT, GERMANY. FROM PETERS' *Pictorial History of Ancient Pharmacy and Medicine.* SEE PAGE 357.

While at Basle he fell afoul of the apothecaries. He denounced their drugs and their ignorance. He said, "The apothecaries are my enemies because I will not empty their boxes. My recipes are simple and do not call for forty or fifty ingredients." He also demanded the right to inspect the stocks of the apothecaries of the City of Basle. He criticized them for following the line of least resistance in their laboratory work. He says, "They can only compose insipid syrups and repulsive concoctions and they overlook many valuable extracts and dyes in their stills."

He stigmatized physicians' prescriptions as barbarous, and he popularized the use of the word "spagyric" as synonymous with hermetic, as applied to the art of chemistry. For his offenses against both physicians and pharmacists he was threatened with imprisonment, so he again departed, this time for Alsace, where he astonished people by his many cures. He then settled for a time in Esslingen, Wurttemberg, where he fitted up a laboratory for alchemical and astrological experiments and studies.

Again he took to the road and this time went to Nuremberg, which he reached in 1529. Here he prepared to publish a medical work but the medical faculty brought pressure to bear upon the authorities and the sale of the work was pro-

hibited. Even free Nuremberg was not free to Paracelsus. He went to Ratisbon, where he spent some time in writing several of his works. Later he went to St. Gall, where he ministered to the health of the poor free of charge, and continued his writing. He spent the following three years distributing the Bible in Switzerland, but was driven out by the enraged priests. The Bible was not yet for the common people.

He next journeyed to Innsbruck, to Stertzing, to Ulm, and finally to Vienna, constantly practicing medicine and writing. At this time (1537) his father died and he received the property which had been bequeathed to him. He then continued his wanderings until he finally reached Salzburg where he died in 1541.

During this peripatetic existence, Paracelsus had written and published many books. He had founded a new school of medicine, which came to be called the school of Iatro-chemists (medical chemists). He instituted the practice of giving chemical substances internally as medicines, and employed compounds of antimony, mercury, and other metals in this manner. He first used the word "laudanum," although it was not a liquid preparation, and it is not even certain that it was a compound of opium. He used the

preparation as a secret remedy, of which he said "*Ich hab ein Arcanum, heiss ich Laudanum; ist über das alles wo es zum Tod reichen will.*"

He revived the "doctrine of signatures," which was to play such an important part in medicine and pharmacy in the next century, where we shall have more space to devote to it. He denounced the false goal of alchemy, although he admired it as a science, agreeing in this respect with Martin Luther, who had said "The Art of Alchemy is in truth and in fact the philosophy of the wise." Paracelsus said the object of alchemy should be to prepare medicines, not to search for gold. He is said to have been influenced in his alchemistic views by the work of Isaacus Hollandicus. He added the trinity—mercury, salt, and sulphur—to the four hitherto respected elements earth, air, fire, and water.

As a physician and a pharmacist Paracelsus deserved some of the very criticisms which he launched at the members of both of these professions, for some of his remedies were repulsive, others were based upon superstition. He employed hellebore root for epilepsy, but he stipulated that it must be gathered on a Friday during the waning of the moon. He made remedies from herbs by allowing them to putrefy and then dis-

tilling the putrefied material. He relied upon "quintessences," and defined the term thus: "Every substance is composed of various elements, among which there is one which dominates the others and impresses its own character upon the compound. This dominating element, disengaged, is the quintessence."

He used oil of eggs, made by distilling hard boiled eggs. Oil, from the skull of a man who had never been buried, obtained by distillation, he used for epilepsy. This was used in a preparation called *Confectio Antiepileptica,* of which a formula is given by Oswald Crollius, an alchemist of the sixteenth century, who was an interpreter of Paracelsus but who is better known for his early description of the method of preparing calomel, in a work called *Basilica Chymica.*

Many of Paracelsus' writings have an undoubted ring of sincerity. In the *Labyrinth of Medical Errors* (see illustration No. 13 p. 104) he wrote:

> The practice of medicine is the art of restoring the sick to health. Modern medicine is, to a great extent, looked upon and employed as if it were a system by which man by his cunning and cleverness may cheat nature out of her dues and act against the laws of God with impunity, while to many persons calling themselves physicians, it is merely a method of making money and of gratifying their vanity.

He was the author of one of the earliest of a type of cure known as a "sympathetic remedy." The remedy was to be applied, not to the wound itself but to the weapon which had caused the wound. We shall discuss this further when we come to Sir Kenelm Digby in the next century.

And so we reach the close of the story of this interesting character. The translated epitaph on his monument at Salzburg reads as follows:

"Here lies Philippus Theophrastus, the Famous Doctor of Medicine, who by his wonderful art cured the worst wounds, leprosy, gout, dropsy, and other diseases deemed incurable and, to his honor, shared his possessions with the poor."

The Encyclopedia Britannica calls him "the pioneer of modern chemists and the prophet of a revolution in science." Browning makes him say prophetically:

> "In some time, His good time, I shall arrive;
> He guides me."

Contemporaneous with Paracelsus was Georg Agricola, a metallurgist of Leipzig, who left several illustrated works of great value. He gave descriptions of the smelting of lead, tin, bismuth, iron, and antimony, and of the manufacture of salt, saltpetre, alum, and copperas.

Among the sixteenth century contributors to pharmaceutical and chemical literature are several who must not be forgotten. Andræus Libavius studied chemistry and medicine and surgery in Halle, and later taught in Rothenburg and Koburg. He was another believer in transmutation, but his *Alchemia,* published in 1595, is more concerned with the art of preparing chemicals for technical and medicinal purposes. One of the discoveries for which he is remembered is the solution of stannous chloride, which was long known as *"Spiritus Fumans Libavii"* or the fuming liquor of Libavius. He was a specialist in the crude method of analysis of his day and wrote concerning the testing of minerals and the properties of mineral waters.

Raymund Minderer was from Augsburg. He was born in 1570 and died in 1621. The *Spiritus Mindererus* of modern pharmacy was originated by him. He contributed numerous other preparations to the pharmacopœias of the following century, none of which have survived.

A great French pharmacist of the sixteenth century was Nicholas Houel (1520–1584), the founder of the *Ecole de Pharmacie* at Paris. He was a retail apothecary who amassed a fortune in his profession and endowed a "House of Christian Charity," which was to be a school for

young orphans, who were to be instructed to serve and honor God, to acquire good literary instruction, and to be taught the art of the apothecary. This institution comprised a chapel, a school, a complete pharmacy, an herb garden, and a hospital. The hospital later became the *Hotel des Invalides.* The school for a time was in the hands of the Roman Catholic Church, but in 1622 was restored to the Society of Apothecaries, and in 1777 was made a College of Pharmacy, which it has since remained.

Another interesting character of the sixteenth century was Jerome Frascator (*Hieronymus Frascatus*). He was a pharmacist, physician, and poet. He was closely attached to Pope Paul III. He invented a celebrated preparation for the plague, called *Diascordium,* which appears in some of the later pharmacopœias. As a poet he is said to have written the finest Latin verse since the days of Virgil. His principal poem was published under the repellant title of *Syphillides, sive Morbi Gallici.*

Jacobus Theodorus Tabermontanus was the author of a German herbal, published in 1588 in Frankfort.

Leonardus Fuchs was another botanist who published a herbal in German some years previous to that of Tabermontanus.

Conrad Gessner, who was born in 1516 and died in 1565, was probably the greatest botanist of his century. Other botanists of the same century, whose names have come down to us in the nomenclature of plants or drugs were Lonicerus, Clusius, Lobelius, Matthiolus, Alpinus, Lusitanus, and Cæsalpinus.

Let us now turn our attention to the subject of alchemy during the sixteenth century, the kind of alchemy which was so bitterly denounced by Paracelsus, who might have written the following verse, for it so clearly embodies his thought:

> "When fire and water, earth and air
> In love's true bond united are,
> For all diseases then be sure
> You have a safe and certain cure.
> I will affirm it's here, alone
> Exists the Philosopher's Stone.
> This is fair nature's virgin root,
> Thrice blest are they who reap the fruit;
> But oh! where one true adept's found
> Ten thousand thousand cheats abound."

Paracelsus' criticisms of alchemy and his attempts to direct the misspent energy into channels of value and productiveness had little effect during his lifetime or the fifty years immediately following his death, for the sixteenth century wound up in an alchemistic orgy that made the

previous century look tame in comparison. Even the leaders like Paracelsus, although denouncing it, were not proof against the seductions of this illusive search. Many there were who had no other idea of alchemy, and who like Bernard Trevisan, in the previous century, spent their entire lives in the search; others dabbled only occasionally.

Denis Zachaire was an alchemist of the early part of the sixteenth century whose book, the *Opusculum Chemicum,* contains an account of his years of search that almost duplicates the experience of Bernard Trevisan. He too claims to have accomplished the quest at the last, but his book either conceals the fact or is an imposture.

Another alleged successful adept was Berigard of Pisa, who records his triumph in the *Circulus Pisanus.*

Thomas Charnock was an "unlettered scholar and a student in astronomy and philosophy" from England, according to his own characterization. He also claims to have been successful in transmutation and reports the facts in the *Enigma of Alchemy,* published in 1572. His *Breviary of Philosophy* was a book describing all of the necesary apparatus.

Giovanni Bracceso, an Italian, was a sixteenth

century commenter upon and admirer of Geber, who had practiced the art eight hundred years previously. His best known book is *Legno della Vita* (The Wood of Life), a name which he gave to the object of the quest. He also called it the *Universal Balsam* and the *Universal Panacea.*

Leonardi di Fioraventi, a Florentine, was a sixteenth century alchemist, pharmacist, and surgeon who published a *"Summary of the Arcana of Medicine, Surgery and Alchemy"* in 1571. He is frequently quoted as the author of pharmaceutical preparations in the following century.

John Dee and Edward Kelly belong together just as certainly as do Mutt and Jeff, Castor and Pollux, or Thomas and Jeremiah. John Dee was an English scholar and mystic, whose standing in society may be appreciated when it is learned that he was the instructor of Queen Elizabeth in alchemy and philosophy and held a permit as an alchemist given by her to him. His career seems to have been perfectly circumspect and proper, despite the fact that he had a " crystal ball " or " shew-stone," and was reputed to be a necromancer. (See illustrations Nos. 17 and 18, opposite pages 140 and 148.)

In some way he came to be associated with and, for some years, almost completely under the domination of Edward Kelly. Edward

Kelly's true name is said to have been Talbot; he was originally a lawyer and is said to have lost both his ears in consequence of having been convicted of and punished for having used his scrivener's art in the falsification of deeds. Then, too, Kelly was a "skryer," one who could see the visions in the crystal ball, and together he and Dee held many seances, recorded in ponderous volumes which read like some of our modern spiritualistic literature, from the irrelevancy of the answers of the controls. Kelly somehow came into the possession of a portion of the philosopher's stone, which had been discovered in the ruins of Glastonbury Abbey, according to the story. After having proved its power Kelly and Dee set out on a tour of Europe and soon became attached to the group that surrounded Rudolph II of Bohemia, of whom we shall hear presently.

While they were abroad, Doctor Dee's "friends and neighbors," who believed him to be a magician, sacked his house at Mortlake and destroyed much of his library and apparatus. Kelly died in Germany after having been imprisoned for having failed to duplicate his former successes at transmutation. Doctor Dee returned to England and died at Mortlake after having been Chancellor at St. Paul's and Warden of Manchester College. His crystal ball and other

apparatus and many of his books are in the British Museum.

Henry Kuhnrath was a follower of Paracelsus, and was graduated in medicine as Basle at about the time that the father of Iatrochemistry taught in that institution. He wrote the *Amphitheatrum Sapientæ Æternæ Solius Veræ,* which is a mystical and magical alchemistic treatise.

Michael Maier was a celebrated German alchemist, who had been born in Verona and who was private secretary and personal physician to Rudolph of Bohemia. He was of the Rosicrucian type of alchemist, although that mystic order had not yet appeared. He established a brotherhood of a similar kind. He wrote a number of alchemistic books, all with ponderous and enigmatic Latin titles. His books have been termed hermetic elaborations of classical mythology and are adorned with many curious illustrations.

Jacob Boehme, who has been called the "illuminated shoemaker of Gorlitz," was the central figure of the wave of Christian mysticism which entered alchemy in the sixteenth century and the one which followed. Boehme had quite a following. He and his associates believed that the secret of the philosopher's stone "was concealed

FIG. 30.—SYMBOLIC FRONTISPIECE OF AN ITALIAN PHARMACEUTICAL WORK OF THE SEVENTEENTH CENTURY. SEE PAGE 297.

in the text of the Bible and particularly in Revelations."

He had visions and wrote books concerning them. The *Vera Principia, Mysterium Magnum,* and *Signatura Rerum,* are examples of the titles. Of himself he wrote:

> "Whate'er the Eastern Magi sought,
> Or Orpheus sung or Hermes taught,
> Whate'er Confucius could enspire,
> Or Zoroaster's mystic fire;
> The symbols that Pythagoras drew,
> The wisdom God-like Plato knew,
> What Socrates debating proved,
> Or Epictetus lived and loved;
> The sacred fire of saint and sage,
> Through every clime in every age,
> In Boehme's wondrous page we view
> Discovered and revealed anew."

It is certain from this that he suffered from no inferiority complex.

The Rosicrucians were members of a secret organization which was an outgrowth and blend of occultism, mysticism, and chemistry. It took its name from its founder, Christian Rosenkreuz, whose patronym was probably coined from Rosa and Crux. The members of this society were called "Brethren of the Rosy Cross."

The origin of the organization is shrouded somewhat in mystery. Mystical philosophy had

developed considerably in Europe during the sixteenth century, particularly in Germany, where this cult started. The influence of Paracelsus probably had an effect upon this movement. Rosenkreuz, the alleged founder, was said to have been born in 1459 and died in 1502. His *magnum opus* was *Die Chymische Hochzeit.*

The society was first heard of in 1615 through a manuscript called *Confessio Fraternitates R. C.* It had a limited membership and its objects were the pursuit of knowledge and the study and practice of the healing arts in particular. In some ways it resembled Freemasonry, but there is no traceable connection between them. There were supposed to be sixty-three members who used signs and passwords for recognition. The brethren claimed to possess the power of transmutation and also the secret of the elixir of life. The former they called the " Gift of God," and never used it for purely material purposes. They dealt with invisible beings called elementals and believed in nymphs, gnomes, undines, and salamanders.

There was a branch of the Rosicrucians in England and the Kentish alchemist, Robert Fludd, was supposed to be a member of the order. Cagliostro in the eighteenth century is claimed by some to have been one of the brethren, but

historians of this movement state that the original order had no connection with alleged Rosicrucians of the later centuries.

Bulwer, in his novel called *Zanoni,* deals with this mystic sect in a very entertaining manner.

In that period of Queen Elizabeth's reign, when a new world to the westward was claiming the attention of pioneers, adventurers and statesmen, the Court of Rudolph of Bohemia was the scene of the greatest assemblage of savants and swindlers, alchemistic tricksters and scientific mountebanks ever known. Rudolph II was born in 1552, and was the son of Maximilian II of Germany. He was also the nephew of Philip II of Spain. He was at first King of Hungary, later was made King of Bohemia, and in 1576 succeeded to the throne of his father as Emperor of Germany. He immediately moved the capital of the kingdom from Vienna to Prague, cast the entire responsibilities of his several titles upon his ministers and executives, and devoted himself with great zeal to the accumulation of art treasures and the cultivation and study of science, not the science which we know today, but the lunatic fringe which included astrology, magic, and the baser sort of alchemy.

In a short and narrow street in Prague known

as "Gold Alley," lived the hermetic philosophers, occultists, and spagyrists. They came from all over Europe, attracted by the liberality of Rudolph, who entrusted much of the detail to Dr. von Hayek, the director of his laboratories.

To Rudolph's laboratory came a procession of sharpers, swindlers, and charlatans, traveling under the guise of alchemists, such as was never recorded before nor since. They came from every European country as well as from the Orient, and here it was that serious minded scientists like John Kepler and obvious charlatans like Edward Kelly rubbed elbows in the narrow streets of Prague.

Many were the deceptions practiced by the seekers of Rudolph's favor. Dr. von Hayek describes the following as examples:

> Some used double-bottomed crucibles, the false bottom being fusible and containing the gold, which would then appear in the flux after the operation. Others employed hollow tubes for stirring the ingredients, the gold being secreted within the tube, and the bottom being stopped with wax, which melted and allowed the gold to mix with the contents of the crucible when the apparently solid rod was used for stirring purposes. One adept had saturated a piece of charcoal with a solution of a salt of gold and mixed this with the plain charcoal employed as a reducing agent in the flux.

Although many of the individuals were credited with having accomplished the transmutation

of baser metals into gold (in some instances the most minute details of procedure were given and the authenticity of accomplishment attested by men of the highest reputation), not a single one of the group which visited Rudolph left any impress upon the history of chemistry proper.

In 1612 Rudolph died after a reign of thirty-five years, which period constituted the high water mark of the alchemistic search for the philosopher's stone. There is no evidence that an ounce of gold was ever created by any of these alchemists, and although many votaries and patrons of the art are reported to have left immense amounts of gold and silver in their strong boxes, it is probable that the source of the wealth must have been some other than the hermetic art.

In 1582 appeared a curious volume, profusely illustrated, and purporting to be the alchemistic treatises of Solomon Trismosin, an adept and teacher of Paracelsus. This book is called *Splendor Solis,* and has been reprinted in modern form. It is well worth perusal by any one interested in alchemical lore.

We have now come to the end of the sixteenth century, a great period, to many the greatest century of all in the interest of its happenings and the remarkable characters which it produced.

CHAPTER VIII

THE CENTURY OF FAMOUS PHARMACOPŒIAS AND NOTABLE CHARACTERS. THE GOLDEN SEVENTEENTH

"Long has he been of that amphibious fry,
Bold to prescribe and busie to apply,
His shop the gazing vulgar's eyes employs
With foreign trinkets and domestick toys.

Here mummies lay most reverently stale,
And there the tortoise hung her coat of mail;
Not far from some large shark's devouring head,
The flying fish their finny pinions spread.
Aloft in rows large poppy heads were strung,
And near, a scaly alligator hung,
In this place drugs in musty heaps decayed,
In that dried bladders and drawn teeth were laid."

Dr. Samuel Garth, a physician, politician, and litterateur of his time, wrote the foregoing description of the seventeenth century apothecary and his shop. With a little imagination one can picture the drug store of that period as a gift shop, but the soda fountain and lunch counter idea had evidently not yet appeared. In Great Britain the apothecaries of the early seventeenth century were still combined with the grocers.

The sixteenth century legislation which had united these two dissimilar groups had also given the members of the Faculty of Medicine the right to practice medicine, pharmacy, and surgery. The assistants and apprentices of these medical men were called apothecaries and they performed minor surgical and medical duties, compounded their masters' prescriptions, and prepared the stock supplies of medicines.

As these assistants became skilled in the art of pharmacy they established themselves independently as apothecaries and united with the grocers in a common guild in 1606. This guild however, was subservient in some respects to the physicians, for the members were warned that when they made a dispensation of medicine (probably meaning theriac in particular) they should "expose the several ingredients to open view in their shops for six or eight days so that the physicians passing by might judge of the goodness thereof, and prevent their buying and selling any corrupt or decayed medicines."

It is natural to suppose that there would be resentment on the part of the apothecaries, both against the humiliation of being subservient to the physicians, and also against being forced to unite with the grocers, with whom they had little in common. The apothecaries soon took steps to

sever their connection with the guild of grocers, and appealed to James I, who was King. The strongest factor in their ultimate success was the King's physician, Sir Theodore Turquet de Mayerne.

Mayerne was a Swiss by birth but was educated at Heidelberg, Montpellier, and Paris. He became popular in Paris as a lecturer on anatomy to the physicians and as a lecturer on pharmacy to the apothecaries. His original name was Turquet, but he added "de Mayerne." He became physician to Henry IV of France. About 1600 he wrote a treatise advocating the use of mineral medicines, particularly the antimonials and mercurials. Partly for this reason, for the wave of sentiment was beginning to turn against the Paracelsan or Iatrochemical school of medicine, and partly because he was not of the religious faith approved by the State, he incurred the displeasure of the Paris Faculty of Medicine to such an extent that he was virtually expelled from the profession.

The wording of the French edict was as follows:

The College of Physicians in the University of Paris, being lawfully congregated, having heard the report made by the censor to whom the business of examining the apology published under the name of Turquet de Mayerne, was

committed, do with unanimous consent condemn the same as an infamous libel, stuffed with lying reproaches and impudent calumnies, which could not have proceeded from any but an unlearned, impudent, drunken, mad fellow; and do judge the said Turquet to be unworthy to practice physick in any place because of his ignorance, rashness, impudence, and ignorance of true physick; but do exhort all physicians which practice physick in any nations or places whatsoever that they will drive the said Turquet and such like monsters of men and opinion out of their company and coasts; and that they will constantly continue in the doctrine of Hippocrates and Galen. Moreover they forbid all men that are of the Society of Physicians of Paris, that they do not admit a consultation with Turquet or such like persons. Whosoever shall presume to act contrary shall be deprived of all honours, emoluments and privileges of the University and be expunged out of the regent physicians.

About this same time a physician named Besnier was expelled by the Paris Academy of Physicians for having administered antimony to a patient. It is of interest to note that in 1637 antimonial wine was admitted to the list of published remedies and in 1650 the edict against prescribing it, which had been brought about by the publication of *antimonial martyrology* by Guy Patin, was rescinded. The Galenists and Paracelsans had another battle in France in 1643 in which the former won another temporary victory in again having the use of metallic salts in medicine prohibited.

Mayerne did not, however, confine his medicines to those of chemical origin. He was tinctured with the same credulity which pervaded medicine for hundreds of years, regarding the efficacy of certain animal remedies of disgusting character. The principal ingredient in a remedy for the gout which he frequently prescribed, was the raspings of a human skull of a person who had not been buried. He is also said to have devised an ointment for hypochondria called Balsam of Bats. This contained bats, adders, new born dogs, earthworms, hogs' grease, stagbone marrow, and the thigh bone of an ox.

Mayerne left France and went to England where through the influence of one of his patients, who was an English peer, he became physician to James I of England, who had succeeded to the throne at Elizabeth's death in 1603, and who subsequently knighted him. He had a leaning toward pharmacy and did considerable experimenting with the preparation of new chemical remedies. He is said to have introduced calomel, and also black wash into medical practice. He probably originated the name calomel, the etymology of which is in some doubt, for prior to the use of it under that name it had been called by various other names which will be mentioned hereafter.

He had a sympathetic attitude toward the

NVOVO, ET VNIVERSALE
THEATRO
FARMACEVTICO.

FONDATO

Sopra le Preparationi Farmaceutiche scritte da' Medici Antichi, Greci, & Arabi, principalmente da Galeno e Mesue

APPOGGIATO

Sopra le Preparationi, dette Spagiriche, già da gli Antichi in parte, abbozzate, ma da più Moderni Medici [illegible] meglio coltiuate; scritte dal *Beguino, Crollio, Hartmanno, Libauio, Mosischt, Paracelso, Quercetano, Sennerto* [illegible]

RAPPRESENTIANDI

E le vne, e l'altre Preparationi, per Fondamenti vnitamente necessarij alla vera, & artificiosa Methodo Farmaceutica:

ADORNATO, ET AMPLIATO

Oltre le Fabriche, e Compositioni Medicinali, in qualsisia Forma fabricabili, contenute n[illegible] aumentato da *Alberto Strecchini* già Farmacopeo nella Officina dello [illegible], con le Stampe, publicati Antidotarij de più accreditati Autori, e delle p[illegible] *Augusta, Bergamo, Bologna, Colonia Agrippina, Fiorenza, Londra, Messina, Roma, & Altri*, con quelle Fabriche, e Compositioni ancora, le quali fussero state descritte da gli più lodati Scrittori dell'Arte Medica, ouer mutate da' più dotti Lettori, e Professori della Medesima:

ABONDANTISSIMO

[illegible] Antecessori, di modo remissim, [illegible] ora de tutti gl'altri Auuertimenti, [illegible] ta Dispositione, A[illegible], Vnione, e Compositione [illegible] Semplici, e Composite, cauabili da Animali, Vegetabili, e Minerali:

Necessario A ciascheduno Farmacopeio:

Vtile ad ogni Medico, & Amatore della Medicina:

Curioso per gli Inuestigatori delle più desiderate, & artificiose Preparationi Spagiriche:

[illegible] ALLA LVCE

Da Antonio de Sgobbis da Montagnana *Farmacopeio all' Insegna dello* Struzzo *fù Coadiutore nella Officina Farmaceutica Pontificia* della S. S. di PP. VRBANO VIII. di F. M., *Aggregato al Celebre Romano, e già Priore del Nobile Veneto Collegio de gli Farmacopei.*

CONSACRATO

ALL' AVGVSTA ED IMMORTAL MAESTA' DEL

PRENCIPE SERENISSIMO, ET ECCELLENTISSIMO SENATO

DI VENETIA.

IN VENETIA, M DC LXVII. Nella Stamparia Iuliana, *Con Licenza de' Superiori, e Priuilegio.*

A Spese dell' Authore.

[illegible] Appresso Gio. Giacomo Hertz, Libraro all' Insegna della Naue in Merceria

FIG. 31.—ELABORATE TITLE-PAGE OF AN ITALIAN PHARMACEUTICAL WORK OF THE SEVENTEENTH CENTURY. SEE PAGE 297.

apothecaries and used his influence with good effect with King James, who, in 1617, gave them a separate charter and an independent existence as a restricted guild which has never admitted to its active membership any but actual practitioners of pharmacy.

The Grocers' Guild, of course, resented the attainment of independence of the apothecaries, probably on account of the loss in membership which followed the withdrawal. The Grocers' Company, in 1624, petitioned the King in opposition to the new guild, but their petition received a solar plexus blow, the importance of which, viewed in the light of the changing meanings of words has never been fully appreciated, so far as I can find, by medical or pharmaceutical historians. King James said to the grocers, in reply to their protest: *"Grocers are but merchants; the business of the apothecary is a mystery; wherefore I think it fitting that they should be a corporation of themselves."*

The key to the interpretation of the foregoing paragraph lies in the seventeenth century meaning of the word "mystery." The meaning of the word at that time, used in such a context as that given above, was "art, craft, or profession," as opposed to merchandising. The phrase "art and mystery of the apothecary," as seen in ancient

indentures, therefore acquires a new meaning, and we must pay tribute to James I as having been the earliest individual on record to coin a phrase equivalent to the modern slogan "Your druggist is more than a merchant." The words "art and mystery of the apothecary" in modern language would be "art and profession of pharmacy."

In 1632 the Apothecaries' Company, as this Guild was called, acquired a hall in Cobham House. They were aided in this effort by Gideon de Laune, apothecary to Queen Anne of Denmark who became the wife of James I. De Laune had also aided them originally in obtaining their charter. One of the prominent early members of the Society was Thomas Johnson, author of the finest amplified edition of *Gerarde's Herbal* ever published. Johnson is also noted for having exhibited in his apothecary shop at Snow Hill, at about this time, the first bunch of bananas ever seen in London, nearly three hundred years before the advent of the "banana split."

During its first century the Society weathered the storms of civil war, and the great plague epidemic of that period, besides many financial hazards, and the hall, which was rebuilt in 1676, after the Great Fire of London had destroyed the first one, still stands.

There are said to have been only 114 apothecaries in London in 1617, the year that the charter was granted to the Guild, so it can easily be seen that such a small organization would have difficulty in meeting its regular obligations, to say nothing of the assessments levied by the King on all the guilds upon the slightest pretext. Charles I was about the worst of the lot in this respect for he demanded money from the Guild to help provide a fleet to aid Spain against Holland, and within a few years came back again for a " compulsory loan " of a sum equivalent to $1500, for the raising of which they were compelled to rent the hall to other organizations instead of maintaining it for their own exclusive use.

Prior to acquiring their hall they had established a manufacturing laboratory and dispensary in common. In 1674 the Guild established a garden, then called a " physic garden," as it was mainly devoted to medicinal plants. This was called the Apothecaries' Garden of Chelsea, which still exists today, the history of which is so entertainingly described in the recent book of F. D. Drewitt.

While the Guild of Apothecaries was in process of organization there was being prepared, largely through the instrumentality of Sir Theodore Turquet de Mayerne, the first *London Phar-*

macopœia. This appeared in 1618 in Latin under the title *Pharmacopœia Londonensis,* usually abbreviated during the three centuries of its existence as "P. L." This book was intended to serve as a standard for the physicians of England in general. It was more of a compilation of older authorities than anything particularly original. It is said to have been largely based on the *Formulary* of Mesue which appeared during the Arabian period. Some of the formulas of Gilbertus Anglicanus, a contemporary of Roger Bacon, also appeared therein.

The famous *antidotus Mithridatica Damocratis* found a place in this work, as did also *electuarium theriacale magnum,* which was another polypharmacal conglomeration intended to replace the imported theriac. *Philonium* and *dioscordium* were two other formulas in the first *London Pharmacopœia,* which went back to Greek and Roman times for their origin.

This celebrated pharmacopœia was sponsored by the London College of Physicians, which had been chartered under Henry VIII. The first steps toward its compilation had been taken the previous century. In 1585 the College had considered it, but as it was of such great importance nothing was done until 1589, when ten committees were appointed. It will be interesting to

modern pharmacopœia committees to see how the work was subdivided.

The entire ten committees were distributed among the classes of pharmaceutical preparations, as follows: 1. Syrups, Juleps and Decoctions. 2. Oils. 3. Waters. 4. Liniments, Ointments, Cerates, and Plasters. 5. Juices, Conserves, Candies, and Confections. 6. Extracts, Salts, Chemicals, and Metallic Preparations. 7. Powders and Dragees. 8. Pills. 9. Electuaries, Opiates, and Eclegmas. 10. Lozenges and Eye Salves. The absence of tinctures will be noted.

It will be seen that the Paracelsan reforms had found a foothold in the work of Committee No. 6. There was evidently no hurry or bustle in the work of these committees, who worked in silence as far as the minutes of the College are concerned, for twenty-five years, when eight additional Fellows of the Society were appointed to examine the *Antidotarii,* which had appeared during the previous century and which were in extensive use in Continental Europe. These additional members of the committee must have been a very energetic group, for within two years an editing committee was appointed and all collaborators were asked to send in their formulas.

Sir Theodore Turquet de Mayerne wrote the preface and in May, 1618, the volume appeared.

King James I immediately issued a proclamation requiring all apothecaries in the realm to obey this pharmacopœia. The first edition was so full of errors, owing to the haste of the printer to rush the work through, that a second and corrected edition was issued by the College in December of the same year in which the blame for the errors was placed upon John Marriot, the printer.

This work, the first pharmacopœia to be officially adopted by a nation, although it bore the name of a city only, was a very large book compared with modern pharmacopœias. It contained 1028 simple drugs and 932 preparations and compounds. There were 91 animal drugs, 271 herbs, 138 roots, and 138 seeds. In the list of preparations there were 213 distilled waters, 115 conserves, 58 electuaries, 45 lozenges, 53 ointments, 51 plasters, and 17 chemicals.

The most complicated preparation was the *antidotus magnus Matthiole,* which called for 130 ingredients, some of which were complex in themselves.

This London Pharmacopœia was revised three times within the seventeenth century, the respective dates of issue of the revisions being 1650, 1659, and 1678. In the edition of 1650 appears that drug that was frequently mentioned as one

of the horrible examples of the older materia medica—Usnea.

Usnea was particularly an English drug. Serapion probably did not think of it because it was not available in his time. It consisted of the moss from the skull of a man who had died a violent death. It was obtainable in England because those were the days when the bodies of criminals who had been executed were suspended in chains at cross roads and in public places as a warning and deterrent to other criminals. This exposure was conductive to the growth of moss on the skull. The skull itself was also used in medicine.

Another interesting article of one of the later revisions of the same work in the seventeenth century was *Aqua Vitæ Hibernorum, sive Usquebaugh.* This was the prototype of our modern whisky, which had been made in Ireland for several centuries under the Gaelic name of *Uisque beatha,* which means "water of life" (see illustration No. 39, page 344).

Other famous authoritative municipal pharmacopœias of the seventeenth century were the *Pharmacopœia Augustana,* 1627 (see illustration No. 35, opposite p. 310); the *Antidotarium Romanum* of Frankfort, 1624; the *Pharmaco-*

pœia Coloniense, 1627; the *Pharmacopœia of Amsterdam,* 1636; the *Codex Parisensis,* 1639; the *Pharmacopœia of Lille,* 1640; the *Antidotary of Bologna,* 1641 (see illustration No. 22, opposite p. 180); the *Pharmacopœia of Toulouse,* 1695; *Ricettario Florentino,* 1696 (see illustration No. 41, opposite p. 364); and the *Pharmacopœia of Brandenburg,* 1698.

Many works of a similar nature were privately issued during this same century, some of which went through numerous revisions and acquired a standing equal to those just mentioned. In this list will be found the *Pharmacopœia Dogmaticorum Restituta* of Joseph Duchesne, who called himself Quercetanus. This was the work which Mayerne favored and which led to his expulsion from Paris and the immeasurable gain of Great Britain, where he settled after leaving France. There were two noted pharmaceutical authorities of this century who wrote under the *nom de plume* of Quercetanus. One was Joseph Duchesne; the other was Nicholas Chesneau.

Other privately issued works were: *Syntagma Arcanorum Chymicorum* of Andre Libavius, 1603; *Antidotarium Vueckero,* 1608; *Basilica Chymica* by Oswald Crollius, 1609 (see illustration No. 23, opposite p. 192); *Dispensatorium Medicum* by Jean Renou, 1615; *Antidotarium*

Quercetani, 1619; *Pharmacie et Medicine Militaires* by Raymond Minderer, 1621; *Pharmacopœia Spagirica* by Poterius, 1622; *Thesaurus Pharmaceuticus Galeno Chymicus* by Arnold Weickard, 1626; *Thesaurus Armamentarium Medico-Chymicum* by Adrian Mynsycht, 1631; the *Paris Pharmacopœia of 1637* (see illustration No. 42, opposite p. 372), republished in 1639 as a Codex; the *Pharmacopœia of Leyden,* 1638; the *Pharmacopœia of Brussels,* 1639; *Pharmacopœia Medico-Chymica* of Schroeder, 1641 (see illustration No. 24, opposite p. 198); *Pharmacopœia of Burdigal,* 1643; *Pharmacopœia of Straslund,* 1645; *Pharmacopœia Spagirica* and several similar works of Johann Rudolph Glauber, 1646; *Pharmacopœia of Toulon,* 1648; *Pharmacopœia of Valenciennes,* 1651; *Pharmacopœia Regia* of Johann Zwelfer, 1652; *Pharmacopœia of The Hague,* 1652; *Culpeper's English Physician,* 1656 (see illustration No. 25, opposite p. 210); *Pharmacopœia of Utrecht,* 1656; *Pharmacopœia of Louvain,* 1656; *Pharmacopœia of Denmark,* 1658; *Pharmacie Theorique* by Nicholas Chesneau, 1660; *Medicina Pauperum* by Johann Prevost, 1663; the last edition of the *Dispensatory of Valerius Cordus,* 1666 (see illustration No. 12, opposite p. 92); *Salmon's English Physician,*

1670; the *Augsburg Pharmacopœia,* 1673 (see illustrations Nos. 32 and 35, opposite p. 278 and p. 310); *Pharmacopœia of Lyons,* 1674 (see illustration No. 36, opposite p. 318); *Clavis Pharmaceutica* by Friedrich Hoffmann, 1675 (see illustration No. 37, opposite p. 328); *Pharmacie Royale Galenique et Chemique* by Moses Charas, 1676 (see illustration No. 38, opposite p. 336); *Pharmacopœia Acroamatica* by George Wedelins, 1677; *Medicinæ Helvetiorum* by Jacques-Constant Rebecque, 1677; *Teatro Farmaceutico* by Donzelli, 1677; *Pharmacopœia of Switzerland,* 1677; *Antidotarium Romanum,* 1678; *Compositio Medicinæ* by Georg Francesco, 1683; *Pharmacopœia of Barcelona,* 1686; *Pharmacopœia of Stockholm,* 1686; *Pharmacopœia Schroedero* by Hoffmann, 1687 (see illustration No. 39, opposite p. 344); *Dictionnaire Pharmaceutique* by Demeufve, 1689; *Pharmacopœia of Haarlem,* 1693; *Corpus Pharmaceutico-Chymico-Medicum Universale* by Johann Helfrid Jungken, 1694; *Collecteana Pharmaceutica* by Louis Penicker, 1695; *Pharmacopée Universelle* and the *Dictionnaire Universel des Drogues Simples* by Nicholas Lemery, 1697 (see illustration No. 45, opposite p. 398); *Pharmaceutical Formulary* by Michael Ettmuller, 1698; *Pharmacopœia of Saragossa,* 1698.

Although many of these were written by authors who are credited with being physicians or chemists, they are distinctively pharmaceutical works and the length of the list is testimony to the great interest which developed in pharmacy in the seventeenth century.

The word *Theatrum* in some of the titles means a conspectus or a showing. The word *Basilica* means royal. Many of the books have elaborate prefaces and long introductions eulogizing the author or compiler. The dignified and devotional character of some of these introductions are silent testimony to the serious attitude of these authors toward their work. Most of the books were issued *cum privilegio,* as shown by the imprint on the title page.

Most of the works are in Latin throughout. Many interesting things can be learned concerning the history of pharmacy by scanning even a few of them. The use of symbols for substances (see illustration No. 23, opposite p. 192), and also as abbreviations for operations, as well as for weights, measures, and periods of time, are increasingly evident. These symbols date from the Arabian period at least, but were said to have ben popularized by Raymond Lully in the thirteenth century.

Some of the books give the tables in symbols

simply for reference purposes; in others they are used throughout the text with the effect of condensation, but making rather difficult reading for a modern student. One interesting point is noted—almost every recipe is preceded by the appropriate symbol. In the seventeenth century the authors are about equally divided between the use of ℞ and ♃.

It has been observed in several works that both signs are used indiscriminately. In one of these, the *Pharmacopœia Lugdunensis Reformata,* 1674, both signs occur upon the same page in a number of places. One curious fact has been noticed in studying these ancient volumes—although many of these books contain lists of symbols and abbreviations, none has been found which includes the explanation of either of the prescription signs, nor of the skull and crossbones to indicate poisons.

Many preparations which are still in use originated during the seventeenth century, and the formulas are found in one or more of the works given in the list. Among these are the following: Compound Infusion of Senna or Black Draught, which originated about 1600 and was at first known as *Aqua* or *Potio Laxativæ Viennensis,* and was commonly called "Wienertrank." Contemporaneous with this preparation

FIG. 32.—TITLE-PAGE OF A COMMENTARY ON THE *Augsburg Pharmacopoeia*. SEE PAGE 276.

in its origin is the Confection of Senna, which for several centuries was known as *Electuarium Lenitivum*.

The *London Pharmacopœia* of 1650 contained a preparation called "citrine ointment," which, however, contained no mercury and was a very different ointment from the one known by that name today. This latter owes its origin to a proprietary preparation of the following century called "Singleton's Golden Eye Ointment."

The word "laudanum" had been used in a mysterious and enigmatic manner by Paracelsus in the previous century. It is not even certain that Paracelsus used the name in connection with a preparation of opium, although he is said to have carried a piece of opium in a secret place in the pommel of his sword and extolled it as a remedy, calling it "the stone of immortality." For more than a century after Paracelsus the term laudanum was applied to solid preparations, some containing opium, others of a purely mineral origin, as one already referred to in the preceding chapter. The first few editions of the *London Pharmacopœia* contained varying formulas for a solid preparation of opium under the name Laudanum. This preparation contained opium, saffron, castor, diambra, ambergris, musk, and oil of nutmeg, all of which were first to be made into

a tincture which was later evaporated to form a pill mass. Some of the seventeenth century pharmaceutical books discuss this preparation, and also the name. Quercetanus says it is from the Latin *laudo,* to praise, because of its praiseworthy character.

The alcoholic tincture which we know by the name of Laudanum owes its origin to a celebrated English physician named Thomas Sydenham, who was famous during the latter part of the seventeenth century. Sydenham's preparation was made from opium and saffron, extracted with Canary wine, and a corresponding preparation is still official in many foreign pharmacopœias and is represented in the National Formulary by *Tinctura Opii Crocata.* Sydenham first described it in 1669 and speaks of it as being good for the plague. As Sydenham himself is reported to have fled from London during the great plague epidemic of 1665, along with most of the other physicians of the city, his knowledge of this was probably secondhand and was doubtless derived from the experience of the apothecaries of London who are credited in the history of that time with having stood at their posts and remained to help fight the epidemic.

Sydenham's own opinion of the preparation is shown by the following quotation from his

works: "I do not believe that this preparation has more virtues than the solid Laudanum of the shops, but it is more convenient to administer." This shows the soundness of his judgment.

This same physician's opinion of opium and of laudanum is worth repeating here in full, for it reflects the attitude of his period toward a narcotic drug which the whole world now fears and is attempting to control.

> Of all the remedies which a kind providence has bestowed upon mankind for the purpose of lightening its miseries, there is not one which equals opium in its power to moderate the violence of so many maladies, and even to cure some of them. Medicine would be a one-arm man if it did not possess this remedy. Laudanum is the best of all the cordials; indeed it is the only genuine cordial that we possess today.

Here Sydenham's judgment erred.

In 1687 there is found in the *Schroedero-Hoffmann Pharmacopœia* a formula for a preparation called *Electuarium Hystericum seu Ladanum Facile.* This formula shows that Sydenham's preparation had not yet attained prominence and is also an example of the polypharmacy of that period. The following ingredients of this preparation are classified into groups: Of precious stones there were emeralds, sapphires, hyacinths, topaz, coral, and pearls; of roots,

galangal and rhubarb; of gums, opoponax, acacia, galbanum, thus, mastic, bdellium, sarcocolla, and euphorbium; of seeds, coriander, fennel, and cardamom; of miscellaneous drugs, salt, opium, cinnamon, oil of turpentine, honey, alcohol and *Aqua Imperialis. Aqua Imperialis* itself was a compound preparation containing twenty-six ingredients, so in this electuary, which was directed to be given in three grain doses as an anodyne and antispasmodic, there are nearly fifty ingredients.

Compound tincture of benzoin also dates from the seventeenth century. Peru Balsam and Tolu Balsam appeared in commerce from the new world at this time and both were used in this preparation. It was known first under the title of Friar's Balsam and also as *balsamum equitis sanctis victoris* (Balsam of the Holy Victorious Knights) or as *balsamum commendatoris* (Commander's Balsam). Many other synonyms for this preparation appeared in the following century, when it was sold as a proprietary medicine as well as being found in the pharmacopœias.

Lemonade was extensively used as an antiscorbutic by French and Italian physicians in the seventeenth century, and pharmacists were called upon to supply it. A Florentine pharmacist in 1660 conceived the idea of freezing it to make a more attractive dose. This product, which was

really a lemon water ice, or a lemon sherbet was still called lemonade, and acquired great popularity. In 1676 the Lemonadiers of France formed a company under royal authority, and the pharmacists lost the sale of another commodity—for a time.

Many new drugs and chemicals appeared in medical practice during this remarkable seventeenth century. Guaiacum and sarsaparilla had been brought from the new world during the previous century and by this time had become firmly intrenched. Jalap appeared as a new drug from Mexico. Cinchona was brought to Europe about 1638 by the wife of Count Chinchon, Viceroy of Peru, who had been cured of a stubborn intermittent fever by its use. Its virtues were so quickly extolled that within a few years it was in general use throughout Europe.

Being largely distributed by members of the Society of Jesus, Jesuits, as they were called, the drug came to be called Jesuit's Bark, and Jesuit's Powder, Powder of the Cardinal and Powder of the Fathers. It was also called *Polvo de Condesa* (The Countess' Powder), Peruvian Bark, Peruvian Powder, Fever Bark, Red Bark, Yellow Bark, and similar names of obvious origin.

Its popularity was enhanced by the success of a seventeenth century nostrum advertised to

the public in the newspapers of that period as a cure for fever. It was said of its early history that only laymen, charlatans, and semi-professional empiricists were willing to use it. Protestants refused to employ it because of its association with the Jesuits. At first it was worth almost its weight in gold, for even when used empirically in certain kinds of fevers, its curative effects were marvelous.

Talbot, a charlatan in English medical practice, attained great fame by curing first the daughter of a peer and later Charles II, who knighted him and appointed him Royal Physician at £100 a year. Talbot then went to Paris and cured the Dauphin, son of Louis XIV. For this service he received 2000 guineas, a pension of £100 a year and the title of "Chevalier." He then went to Spain, where he cured the Queen (malaria seeming to be a prevalent disease of the nobility at that time), after which he returned to London and died in 1681 at the age of forty.

The greatest handicap to the use of cinchona in regular medical practice, lay in the fact that it upset all schools of medicine of that period, which were based on humors or fluxes. Some of the physicians of that time would rather have died than use a remedy so opposed to the principles of the then existing practice.

Cinchona was the entering wedge that brought about the end of Galenism, which had held undisputed sway for 1500 years. Many physicians of that time would not even use a drug not known or recommended by Galen. Ralph Irving, a later writer upon the subject, says of cinchona. " There are interwoven the story of commercial greed and the efforts of the self-sacrificing pioneer; antagonisms of religious sects and rivalries of nations, distractions bred by medical ethics and personal hatred within professional ranks."

Sydenham was one of the first of the medical leaders to throw off the shackles of prejudice and he used the drug in his practice with great success. Torti, a prominent Italian physician of the late seventeenth and early eighteenth centuries, introduced it into the medical practice of his country, and in connection with its use for ague, coined the word " Mal-aria," literally, " bad air," for the disease (which we now know to be due to a blood parasite, injected by the sting of a mosquito) was associated popularly with the exhalations of marshes.

Coca, another drug from the new world, was also popularized during the seventeenth century. Early travelers who mention it seem not to have appreciated the medicinal or stimulating properties of the drug, for they speak of the curious cus-

tom of the natives of carrying a small leaf in the mouth while traveling. Dr. Abraham Cowley in 1662, however, said of it: "Each leaf is fruit, and such substantial fare, no fruit beside to rival it will dare."

Ipecac made its debut into medical practice through the medium of a secret preparation. There are several detailed accounts of how this came about. They all agree, however, in ascribing its introduction to a preparation made by a quack physician named Helvetius. It is said that Helvetius himself did not know the origin of the drug, which had originally been imported by a physician named Le Gras, who left his supply in charge of an apothecary named Clanquelle.

Le Gras, it is said, had given too large doses of the drug to succeed with it as a remedy. Helvetius obtained some of the drug from Clanquelle and learned to use it properly. He made many remarkable cures of patients suffering from dysentery. His success in these cases was called to the attention of Louis XIV, whose son, the Dauphin, was then cured by Helvetius of the same malady. Louis XIV later paid Helvetius the equivalent of $4000 for the secret of the cure. The formula, when published, proved to be a complex mixture of drugs, of which only one ingredient, called by Helvetius "*Radix Antidysenter-*

ica," later identified as ipecac, proved to be efficacious. For a time ipecac was called "Brazil Root." It was very scarce and its origin was shrouded in much mystery for many years.

The beverages coffee, tea, and chocolate all made their initial appearance in this century, as did also the drugs serpentaria and copaiba from the new world and calumba from Africa, and the flavor vanilla from Mexico.

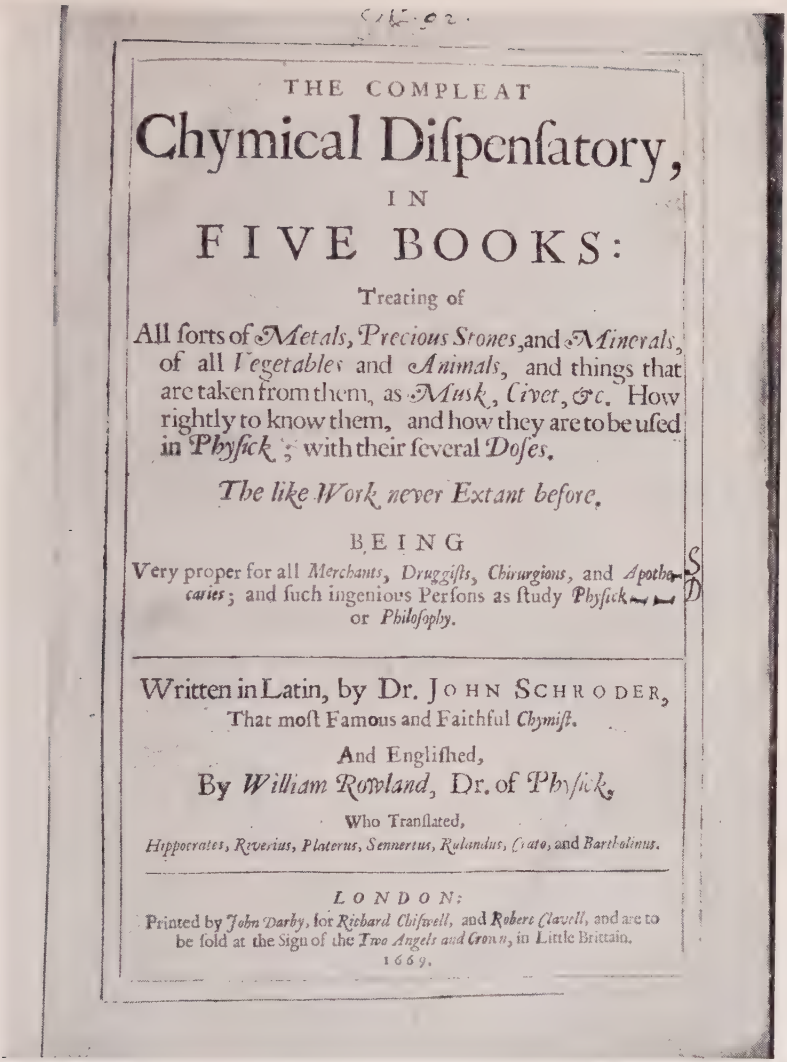
Tobacco smoking had been introduced into England in the early part of the seventeenth century by Sir Walter Raleigh. It spread quickly throughout Europe and was the cause of as much turmoil and prohibitory legislation as alcohol is today. James I wrote a counterblast against the use of tobacco early in the century. This was followed in 1624 by Pope Urban VIII, who issued a decree excommunicating all who took snuff in church. In 1653 the Council of Appenzell forbade smoking in the city, even in the privacy of the home. In 1664 the police regulations of Bern prohibited smoking. This regulation continued in force for about a century. In 1695 Pope Innocent XII revived the Edict of Urban, which had been neglected as to its enforcement.

The Senate of Strasburg, a few years later prohibited the cultivation of tobacco and in Russia smoking was forbidden under penalty of

having one's nose cut off. Today—even the women smoke.

Among the new chemicals of the seventeenth century were Glauber's Salt and Rochelle Salt. Johann Rudolph Glauber was born in Carlstadt, Germany, in 1603. He was an alchemist, an iatrochemist, an analytical chemist, and a manufacturing chemist. He discovered the salt which still bears his name, later identified as sodium sulphate, in the waters of a Hungarian spring, and later obtained the same salt as a by-product in the manufacture of hydrochloric acid, which he first made successfully on the large scale, calling it *spiritus salis marini Glauberi,* because he had made it from sea salt and sulphuric acid by distillation. The sodium sulphate, according to his observations and conclusions, had such marvelous curative properties that he called it *sal mirabile Glauberi.* These early experimenters in the realm of medicine and pharmacy suffered from no inferiority complex when it came to naming their own discoveries.

Glauber was an indefatigable experimenter and observer. He was the first chemist to call attention to the fact that plants made saltpetre from the soil. He prepared the first ammonium sulphate on the manufacturing scale, and sold it for preparing other ammonium salts and com-



THE COMPLEAT

Chymical Diſpenſatory,

IN

FIVE BOOKS:

Treating of

All ſorts of *Metals*, *Precious Stones*, and *Minerals*, of all *Vegetables* and *Animals*, and things that are taken from them, as *Musk*, *Civet*, &c. How rightly to know them, and how they are to be uſed in *Physick*; with their ſeveral *Doſes*.

The like Work never Extant before.

BEING

Very proper for all *Merchants*, *Druggiſts*, *Chirurgions*, and *Apothecaries*; and ſuch ingenious Perſons as ſtudy *Phyſick* or *Philoſophy*.

S D

Written in Latin, by Dr. JOHN SCHRODER,
That moſt Famous and Faithful *Chymiſt*.

And Engliſhed,
By *William Rowland*, Dr. of *Phyſick*,

Who Tranſlated,
Hippocrates, *Riverius*, *Platerus*, *Sennertus*, *Rulandus*, *Crato*, and *Bartholinus*.

LONDON:
Printed by *John Darby*, for *Richard Chiſwell*, and *Robert Clavell*, and are to be ſold at the Sign of the *Two Angels and Crown*, in Little Brittain.
1669.

FIG. 33.—TITLE-PAGE OF AN ENGLISH TRANSLATION OF A *Dispensatory* BY JOHN SCHROEDER, OWNED BY WILLIAM PENN, AND BEARING HIS AUTOGRAPHED INITIALS ON THE TITLE-PAGE. FROM A BOOK IN THE LIBRARY OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE. SEE PAGE 333.

pounds, under the name *sal ammoniacum secretum Glauberi.* He published an exhaustive investigation of pyroligneous acid. He was a sort of consulting industrial chemist of his time, making investigations and researches and selling processes to manufacturers. His enemies asserted that he sometimes sold the same secret to several purchasers, and at other times took money for processes that were not successful. He claimed to have discovered the philosopher's stone, but refused to sell or publish the secret because, as he said "to make this known would encourage the luxury, pride, and godlessness of poor humanity."

Glauber was the first to distil ammoniacal liquor from bones and to synthetically prepare ammonium sulphate and ammonium chloride. He contributed most of the descriptions of chemicals and processes for the pharmacopœias following his period and he published an encyclopedia of chemical processes.

In an old volume of Glauber's which was once owned by Oliver Cromwell, the "Protector" wrote in his own hand: "This Glauber is an errant knave. I doe bethink me he speaketh of wonders that cannot be accomplished." Glauber himself seems to have been sincere. He said in his writings: "I grieve over the ignorance of my

contemporaries, and the ingratitude of men. Men are always envious, wicked, ungrateful. For myself, faithful to the maxim *Ora et Labora,* I fulfil my career, do what I can, and await my reward." He is also the author of a saying which many have found true and which was stated in other words by Poor Richard a century later:

"*Wer seine Sachen will gethan haben richt, muss selbsten seyn Herr und Knecht.*" Glauber departed from the custom of contemporary authors and imitated Paracelsus in publishing his books in the tongue of his native land, Germany, although he gave the titles in Latin. (See illustration No. 26, opposite p. 218.)

Rochelle Salt was accidentally discovered in 1672 by Peter Seignette, an apothecary of the French city of Rochelle. It was also sometimes known as Seignette's Salt in honor of the discoverer. He ascertained that the new compound had laxative properties and advertised it as a secret nostrum called *sal polychrestum,* or "the salt of many virtues," using handbills for the purpose. As illustrative of the importance of the discovery of a new laxative in those times, we learn that the new compound attracted the attention of the Paris Academy of Sciences which had just previously been instituted, and that a description of the salt was published in the *Trans-*

actions of that organization. The composition, however, remained a secret in the Seignette family for two generations, until Geoffroy, a famous pharmacist of Paris, solved the problem, nearly sixty years after the discovery of the salt. The exposure was deemed of such importance that papers were read upon the subject before the Paris Academy of Sciences and also before the Royal Society of Great Britain.

The process for making calomel was first described in the seventeenth century in the *Basilica Chymica* of Oswald Crollius, where it bore the name *arcanum corallinum seu mercurius sublimatus noncorrosivus.* Another author of this century called it *draco mitigatus.* It was also known as *laudanum minerale, panchymagogon quercetani, aquila alba and mercurius dulcis* (dulcified mercury).

The first recorded use of magnesium carbonate internally was during the seventeenth century in Italy, where it was used as a secret remedy or nostrum, under the name of the "Count of Palma's Powder." The word "magnesia" comes from the city in Thessaly near which the deposits of native magnesium carbonate (magnesite) occur. It was sometimes spelled "magnetia," and Paracelsus used the term somewhat obscurely to denote a compound or an amalgam.

Potassium acetate first appeared in medicine and pharmacy in 1610. It was discovered by a pharmacist named Mueller and was named by him *Terra Foliata Tartari.*

Milk sugar was discovered by Bartolette of Bologna in 1619. He first called it *manna seri lactis,* and later gave it the name *saccharum lactis.*

Magnesium sulphate came into use during the seventeenth century in consequence of the popularity of the Epsom Spa in England, which became famous as a watering place and health resort about 1640. Later in the same century, Dr. Friedrich Hoffmann found the waters of the Seidlitz Spring in Germany to contain magnesium sulphate and so the terms Epsom Salt and Seidlitz Salt were used to designate this same substance long before its composition had been established.

This was the century in which the *pil perpetuæ* was used. This was a pill of metallic antimony which could be used over and over again as a cathartic. One of these would serve a whole family during its lifetime and then could be transmitted as an heirloom to posterity.

The bell metal and bronze workers of the seventeenth century made metal mortars for the apothecaries of that time. Many of these have

come down to us inscribed with the date and name of the founder or owner.

Although the Arabic system of notation had been introduced into Europe under the name of the " Gubar numerals " by Pope Sylvester II in the tenth century, they were used without a decimal point until the early seventeenth century, when Simon Steven, usually called Stevinus, a Belgian, first proposed its use.

About this same time John Napier evolved the science of logarithms.

William Shakespeare (1564–1616), from the literary standpoint, has been the wonder of all ages and all lands. We do not know whence he drew his inspiration for his work, but that he was acquainted thoroughly with pharmacy and materia medica is attested by the numerous references in his works to drugs and pharmaceutical preparations and processes. Quotation is made at length elsewhere of the apothecary in *Romeo and Juliet.*

In Wootton's *Chronicles of Pharmacy* a long list of references pertinent to this subject has been collected, in part as follows:

Hamlet's father's ghost speaks of " cursed hebenon," and the word " distilment " occurs in the same play in connection with the revelation of the cause of his death.

In *Macbeth* the witches' cauldron contains "eye of newt and toe of frog," and many other articles esteemed in the materia medica of that time. The word "menstruum" is used in this play, which is a common word in pharmacy at the present day. This had its origin in the practice of allowing maceration of preparations to take place for the period of a month (*mensis,* in Latin).

In *Taming of the Shrew* the directions to "balm his head with warm distilled waters" reflects a practice of the time, a preparation known as *aqua vulnerarii* and another, *aqua comfortatis capitans,* being thus used.

In *Cymbeline* reference is made to "poisonous compounds, movers of a languishing death," and in the same play "Make perfumes, distil, preserve" certainly refers to the art of the apothecary.

In *Henry VI* one of the characters asks "Did the apothecary bring the strong poison that I bought of him?"

In *Pericles* occurs "Give this to the apothecary and tell me how it works."

In *Othello* the reference which reads "drop tears as fast as the Arabian trees their medicinal gum" undoubtedly refers to acacia.

In *King Lear, Henry IV,* and *Henry VI*

there are statements of the poisonous qualities of " ratsbane."

In *Comedy of Errors* a knowledge of Raymond Lully's panacea is evidenced by " I have brought the oil, the balsamum, and the aqua vitæ."

In *Two Gentlemen of Verona* " When I was sick you gave me bitter pills " probably refers to the prototype of the modern compound cathartic pill, which contains aloes, and the inference is plain that there were no sugar coated pills at that time.

In *Othello* " as bitter as coloquintida " refers to colocynth, for that was its former name.

In *Winter's Tale* he refers to " Saffron to color the warden's pies, mace, dates, nutmeg, and a race or two of ginger."

In *Othello,* too, occurs that oft repeated line " not poppy, nor mandragora, nor all the drowsy syrup of the world."

In *Romeo and Juliet* the prevailing belief regarding mandrake is shown by " shrieks like mandrake torn out of the earth."

In *Macbeth* the question " What rhubarb, senna or what purgative drug would scour these English hence," is also illuminating as to the evident prevalence of constipation remedies.

Many other similar quotations might be cited, but enough are given to show the immortal bard's

familiarity with the wares of the seventeenth century apothecary.

Pharmacy did not make as much progress in Germany during the seventeenth century as it might have done, for this was a century marked by civil war and bloodshed in that country. In both Germany and France progress was made along about the same lines as in England as regards attempts at the final separation of the apothecaries from other groups.

In France in 1629, the Society of Apothecaries was awarded a heraldic banner upon which is prominently shown the balance and two galleons, such as brought drugs and spices from far-off lands.

In 1635, Louis XIII established the *Jardin des Plantes,* and passed minor laws affecting pharmacists. Later in the century the master apothecaries in France were separated from the merchant spicers, but were reunited a few years later.

Illustrations of pharmaceutical laboratories and stores of seventeenth century Germany are found in illustrations Nos. 28 and 29, opposite pages 236 and 244.

In Italy there was a marked awakening in pharmacy during the seventeenth century. Many translations of celebrated pharmaceutical works

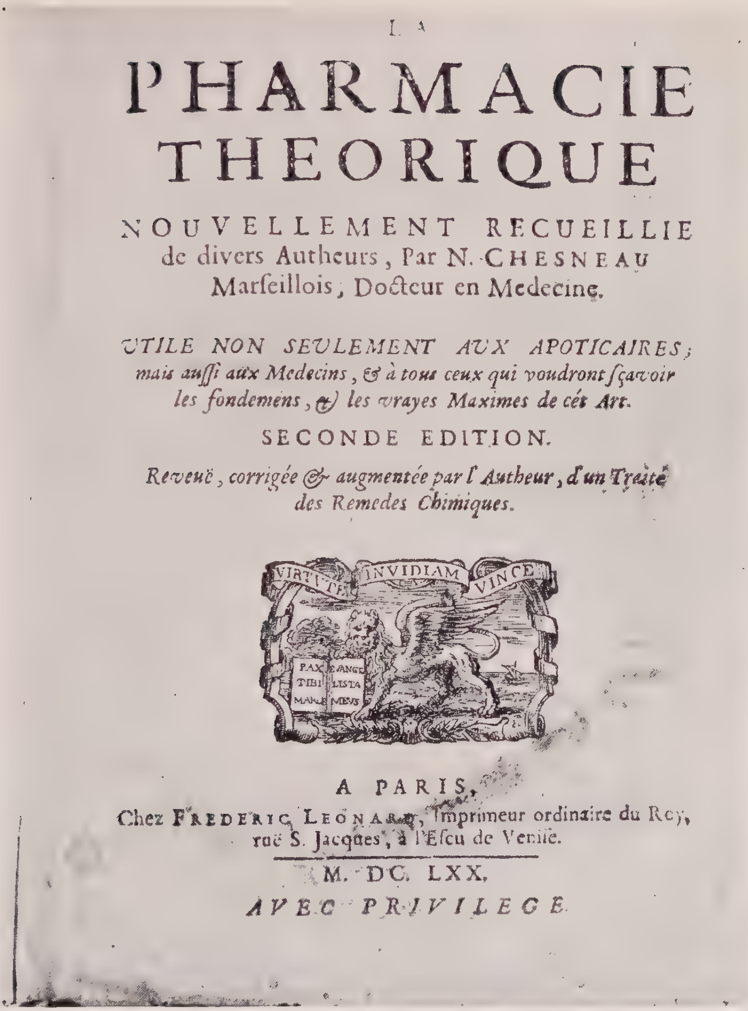
of other nations appeared and quite a number of originals as well (see illustrations Nos. 30 and 31, opposite pages 256 and 266).

In France particularly, although in the other countries to a certain extent as well, came a peculiarly unpleasant period of wholesale poisonings which brought discredit upon apothecaries, physicians, chemists, and all who might have knowledge of or access to the toxic substances used. Poisoning was not a new discovery as an art of getting rid of undesirable people, for Locusta was employed by Agrippina to poison the Emperor Claudius in the time of Nero, and is said to have removed Brittanicus from Nero's path by the same method and at Nero's behest. She was the most famous wholesale poisoner of classic times, and figured in many scandalous events.

Even Nero's time, however, bore no comparison to Europe of the sixteenth and seventeenth centuries in this respect. That the practice had been in effect for some time prior to the seventeenth century and that laws had been passed to prevent it is proved by the scene from *Romeo and Juliet* in which the apothecary is placed in a very unpleasant light. Shakespeare, it will be remembered, died in the early part of the seventeenth century, just after his best work had been accom-

plished. *Romeo and Juliet,* from which the following quotation is taken was published in 1609:

Rom. I do remember an apothecary
And hereabouts he dwells—whom late I noted
In tatter'd weeds, with overwhelming brows,
Culling of simples; meager were his looks,
Sharp misery had worn him to the bones;
And in his needy shop a tortoise hung,
An alligator stuff'd, and other skins,
Of ill-shap'd fishes; and about his shelves
A beggarly account of empty boxes,
Green earthen pots, bladders, and musty seeds,
Remnants of packthread, and old cakes of roses,
Were thinly scatter'd to make up a show.
Noting this penury, to myself I said——
An if a man did need a poison now,
Whose sale is present death in Mantua,
Here lives a caitiff wretch would sell it him.
O, this same thought did but fore-run my need;
And this same needy man must sell it me.
As I remember this should be the house;
Being holiday, the beggar's shop is shut——
What ho! Apothecary!
Ap. Who calls so loud?
Rom. Come hither, man. I see that thou art poor;
Hold, there is forty ducats; let me have
A dram of poison; such soon speeding gear
As will disperse itself through all the veins,
That the life-weary taker may fall dead;
And that the trunk may be discharg'd of breath
As violently as hasty powder fired
Doth hurry from the fatal cannon's womb.



LA

PHARMACIE
THEORIQUE

NOUVELLEMENT RECUEILLIE
de divers Autheurs, Par N. CHESNEAU
Marseillois, Docteur en Medecine.

VTILE NON SEULEMENT AUX APOTICAIRES; mais aussi aux Medecins, & à tous ceux qui voudront sçavoir les fondemens, & les vrayes Maximes de cét Art.

SECONDE EDITION.

Reveuë, corrigée & augmentée par l'Autheur, d'un Traité des Remedes Chimiques.

A PARIS,
Chez FREDERIC LEONARD, Imprimeur ordinaire du Roy,
ruë S. Jacques, à l'Escu de Venise.

M. DC. LXX.

AVEC PRIVILEGE.

FIG. 34.—TITLE-PAGE OF A WORK ON THEORETICAL PHARMACY OF THE SEVENTEENTH CENTURY BY NICHOLAS CHESNEAU, THE PHARMACIST, WHO IS BEST KNOWN UNDER HIS LATINIZED NAME OF QUERCETANUS. SEE PAGE 274.

Ap. Such mortal drugs I have; but Mantua's law
Is death to any he that utters them.
Rom. Art thou so bare, and full of wretchedness,
And fear'st to die? famine is in thy cheeks.
Need and oppression starveth in thy eyes,
Contempt and beggary hangs upon thy back,
The world is not thy friend, nor the world's law;
The world affords no law to make thee rich;
Then be not poor, but break it, and take this.
Ap. My poverty but not my will consents.
Rom. I pray thy poverty and not thy will.
Ap. Put this in any liquid thing you will
And drink it off; and if you had the strength
Of twenty men, it would despatch you straight.
Rom. There is thy gold, worse poison to men's souls
Doing more murders in this loathsome world
Than these poor compounds that thou may'st not sell.
I sell thee poison, thou hast sold me none.
Farewell; buy food, and get thyself in flesh.
Come cordial, and not poison; go with me
To Juliet's grave, for there I must use thee.

The inference here is plain as to the nefarious character of such traffic. There were Venetian, Roman, and Italian schools of poisoners. The term " Italianated " came to be synonymous with suffering death from poison. *Poudre de succession* was the name applied to the substance when given in dry form, for it was so frequently used to hasten the succession in rich or royal families. Among the royal victims of poison, in that period

as well as in the periods immediately before and after, the following have been mentioned by historians: Pope Victor II, Pope Clement VII, Christopher of Denmark, Henry VII of Germany, King John of Castile, Henry IV of France. As far back as the time of Henry VIII in England a law had been passed making the crime of poisoning punishable by boiling alive, and it is said that the penalty had been inflicted once or twice.

In Italy the most famous poisoner of the seventeenth century was a woman named Toffana, who sold and used for the purpose a liquid preparation called *Aqua Toffana, Aquetta di Napoli,* or Manna of St. Nicholas di Bari. This was a colorless, tasteless liquid preparation of arsenic, which was ostensibly sold as a cosmetic, but concerning the toxic uses of which confidential information was given at the time of purchase. Wives who purchased and used this "cosmetic" could get rid of undesirable husbands with little or no difficulty, and for a long time no suspicion attached to this harmless-looking preparation which stood on the lady's dressing table. Toffana is said to have had more than 600 victims to her credit, before she was finally apprehended and executed. Nothing is said of the fate of her accomplices, the wives who administered the poison.

Her most famous predecessors in Italy were the Borgias of the previous century. They were amateurs, however, compared to Toffana.

In France the trouble centered around the notorious Marquise de Brinvilliers, whose cold-blooded experimenting upon the patients in the hospitals that she visited under the guise of charity, is a matter of historical record.

She had secretly, successfully, and artfully poisoned many persons, several of whom were near relatives and others of whom were prominent in Paris. When discovered she fled from France and took refuge successively in Holland and Belgium, being extradited from the later place in 1676. She was executed by decapitation, her body subsequently burned and the ashes scattered to the four winds of heaven.

One curious feature of the Brinvilliers case is the findings of the committee, which subsequently made a report upon the poison used by her, in which it was stated that:

> It defies the researches attempted to be made into its nature; it is so disguised that it cannot be detected—so subtle that it defies all the science and ability of the doctors. Upon this poison all experiments blunder, all rules are false, all aphorisms absurd.

Unfortunately for pharmacy, Christopher Glaser, apothecary to King Louis XIV of

France, became involved in the Brinvilliers case, and left his native land in disgrace.

Glaser was one of the independent discoverers and users of potassium sulphate as a remedy. He called it *sal polychrestum,* for the same reason that the identical title had been given to Rochelle Salt at about the same time by its discoverer. Other early designations of potassium sulphate were *specificum purgans, nitrum fixum, panacea holsatica,* and *sal de duobus. Sal enixum* was the name applied to potassium bisulphate at this time. Glaser was the first pharmacist to make silver nitrate in sticks and sell it under the name "lunar caustic."

The most important result of the Brinvilliers case was the passage of a more stringent poison law in France and the introduction of a poison register, for the first time in history. This law forbade the sale of arsenic, corrosive sublimate, or any other drug reputed to be a poison, by apothecaries, except to individuals known by them personally and who signed the register and stated the purpose for which the poison was intended, which purpose, of course, must be a proper one.

One by-product of this poisoning scare was the greater attention that was paid to the study of toxicology. The treatment for the most part had

been based upon superstitions in which theriac and related preparations had played an important part.

We must not forget to mention the unicorn's horn in this connection. The unicorn is a fabulous, one-horned animal, popularized by Lewis Carroll in his celebrated battle between the lion and that animal. Horns supposed to be unicorn's horns brought enormous prices, as it was believed that a drinking cup made from such a horn would render innocuous any poisonous liquid allowed to stand therein for a short time. As royalty in those days lived in constant dread of poison, and as kings were not teetotallers, as a rule, the demand for unicorn horns for drinking cups exceeded the supply, and one brought as a gift to the King of France in 1553 was valued at a sum equivalent to $100,000. A specimen seven feet long was presented to Charles I. Modern zoölogists who have examined the museum specimens of some of these horns and the cups made from them, tell us that they were the bone-like projections from the heads of the animal called the narwhal.

Bezoar stones were also esteemed as antidotes to poison, but without any basis in scientific fact.

Probably the most celebrated pharmacist of France of the seventeenth century was Nicholas

Lemery (see illustration No. 46, opposite p. 408). He was born in Rouen in 1645, and was largely self-taught, having served as a student assistant for a short time at Montpellier. He had a tremendous influence upon the chemistry, pharmacy, and medicine of his time, both on account of his ability and his pleasing personality, and his books, to which reference has already been made. He became proprietor of a pharmacy in the Rue Galaude, Paris, and there taught chemistry and pharmacy to many students, besides practicing his profession nobly. Fashionable customers flocked to his store and remained to hear his lectures. Students came from distant lands to learn from him. He was a Protestant and was the victim of the storm of religious persecution which swept over France in that century, and which had manifested itself in an edict prohibiting all but Catholics from practicing pharmacy.

The University of Berlin made him a tempting offer which he refused. He fled to England in 1683 and later returned to Paris hoping to find conditions more favorable. He found instead that, following the revocation of the Edict of Nantes, they were worse, so Lemery, for love of his profession and his country, embraced the Catholic faith, and later made his name honored wherever pharmacy is known.

Lemery was the originator of *crocus martis,* a form of ferric oxide which has long since gone out of practical use. He also gave a formula for tincture of gold in which the gold was directed to be dissolved in *aqua regia,* and subsequently compounded with canella and rectified spirit of wine. He adds, as an evidence of his small faith in gold as a remedial agent:

> This tincture is a good cordial because of the essence of canella and spirit of wine.

Stephen Francis (Etienne François) Geoffroy was another French pharmacist of note, who was born in 1672, and most of whose work was done in the following century at which time he will be further discussed. It is interesting to know, in his case, that he was one of two sons of a prominent Paris apothecary, in whose store the first meetings were held of the group that eventually formed the famous Paris Academy of Science.

Nicholas le Fevre was apothecary and distiller to Louis XIV of France. He taught in the *Jardin des Plantes.* He wrote several text books on chemistry which had a wide circulation for many years, in both French and English editions.

He was so prominent in his field that he was invited by Charles II of England to take charge

of the laboratory of the Royal Society, which had then but recently been founded.

Moses Charas was another French apothecary who was a victim of the religious persecutions in that country. He is said to have been the first French pharmacist to prepare the famous *Theriaca* when the plague swept Europe in the seventeenth century. For some years he was demonstrator of chemistry in Paris at the *Jardin des Plantes,* but the revocation of the Edict of Nantes drove him from France to England. Here he was received cordially by Charles II, but he did not remain long, going first to Holland and later to Toledo, where he was called to attend the King of Spain. Here he got in trouble through his scientific habit of mind.

Upon the canonization of an archbishop of Toledo, his sucessor announced that all snakes in that district should henceforth lose their venom. Charas was tempted to make an investigation of the facts, because he was an authority on vipers and had written a book on the subject. His investigation showed that the snakes were continuing to develop poison in the glands which nature had provided for that purpose, in evident ignorance of the archbishop's pronouncement. His investigation and his results were talked about with the effect that he was summoned by the

Spanish Inquisition and imprisoned for some months.

Like his compatriot Lemery, Charas' love for science was greater than his adherence to Protestantism. He embraced the Catholic faith, was released, went back to France, and was subsequently honored by being elected a member of the Paris Academy of Sciences. His *Pharmacie Royale Galenique et Chemique,* previously mentioned (see illustration No. 38, opposite p. 336), was one of the most noted works of its time, and was translated into many languages, including Chinese.

Pierre Pomet was one of the royal apothecaries of the court of Louis XV. He is famous for his *History of Drugs,* which appeared first in 1691, and in many successive editions thereafter (see illustrations Nos. 47 and 48, opposite pages 420 and 428).

A French pharmaceutical authority of note of the early part of the seventeenth century was Jean de Renou (Renodaeus), who wrote many pharmaceutical books. The most noted and popular of these was his *Oeuvres Pharmaceutiques,* which appeared in a number of editions (see illustrations Nos. 20 and 21, opposite pages 160 and 172).

Raymond Minderer was not a pharmacist but

was a famous physician of the early part of the seventeenth century, who lived at Augsburg, Germany, and was medical adviser to the Fuggers (the Rothschilds or Morgans of their day). He wrote a book called *Aloedarium,* in which he recommended a pill which has its counterpart in our modern compound rhubarb pill. He is better known to pharmacists as the originator of the solution of ammonium acetate, commonly called *spiritus Mindereri.* Minderer's original preparation was made from distilled vinegar and crude spirit of hartshorn, and is believed by medical authorities to have had distinctive medicinal properties not possesed by the present day preparation, due to the impurities in the ingredients used at that time.

Adrian Mynsicht was another German physician who left as a legacy to medicine and pharmacy the formula for the preparation called by him *elixir vitrioli Mynsichti,* which is represented in modern pharmacopœias by the frequently prescribed aromatic sulphuric acid. Mynsicht's principal work, the *Thesaurus et Armamentarium Medico-Chymicum,* went through more than a dozen editions in the seventeenth and eighteenth centuries. Mynsicht was the first also to describe the preparation of tartar emetic which he called *stibium tartaricum.*

Franz de Boë Sylvius was a follower of the doctrines of Paracelsus. He was born in Hanau in 1614 and practiced there and also in Amsterdam and Leyden. He wrote an *Opera Medica* in 1680, which concerned itself mainly with chemical remedies.

J. J. Becher was a teacher of chemistry and practitioner who influenced the phlogiston theory through his pupil Stahl in the following century. Becher was born in 1635 and died in 1682. He wandered over Europe considerably, taught medicine for a time in the University of Mainz, wrote many books and finally died in London.

Johann Kunkel, born in 1630, died in 1702, was a German pharmacist, who discovered phosphorus as a constituent of urine. He wrote several chemical works, one of which is said to have stimulated Scheele's interest in that science.

Brandt was an alchemist of Hamburg who had also made the same discovery independently at about the same time. Another German chemist named Wilhelm Homberg is credited also with this discovery. Homberg's father was a pharmacist, but the son had more of a leaning toward chemistry and devoted his life to it. Among his discoveries were boric acid, which he called *sal sedativum Hombergi,* and the separation and

identification of cacao butter. Homberg was the first to manufacture true phosphorus sucessfully in Europe. The luminous substance frequently referred to by other investigators of that time as phosphorus was undoubtedly calcium or barium sulphide.

Jean Rey, a pharmacist and physician of Perigord, became famous for his studies of calcination and similar operations in the early part of the seventeenth century.

Johann Christian Schroeder was a German who studied in various continental European universities. His *Pharmacopœia Medico-physica,* which appeared first in 1641, went through many editions latterly with Hoffmann as reviser and commentator. Hoffmann belongs in the following century.

Jean Baptiste van Helmont was more of a chemist than either pharmacist or physician. He was born in Brussels in 1577 and died near there in 1644. He was of an aristocratic Flemish family of wealth. He studied at Louvain, where he refused a degree because, as he said "academic distinctions ministered to pride." He studied medicine and was made professor of surgery at Louvain. He left the University and the practice of medicine because, having contracted the itch, he was nearly killed by the purging and

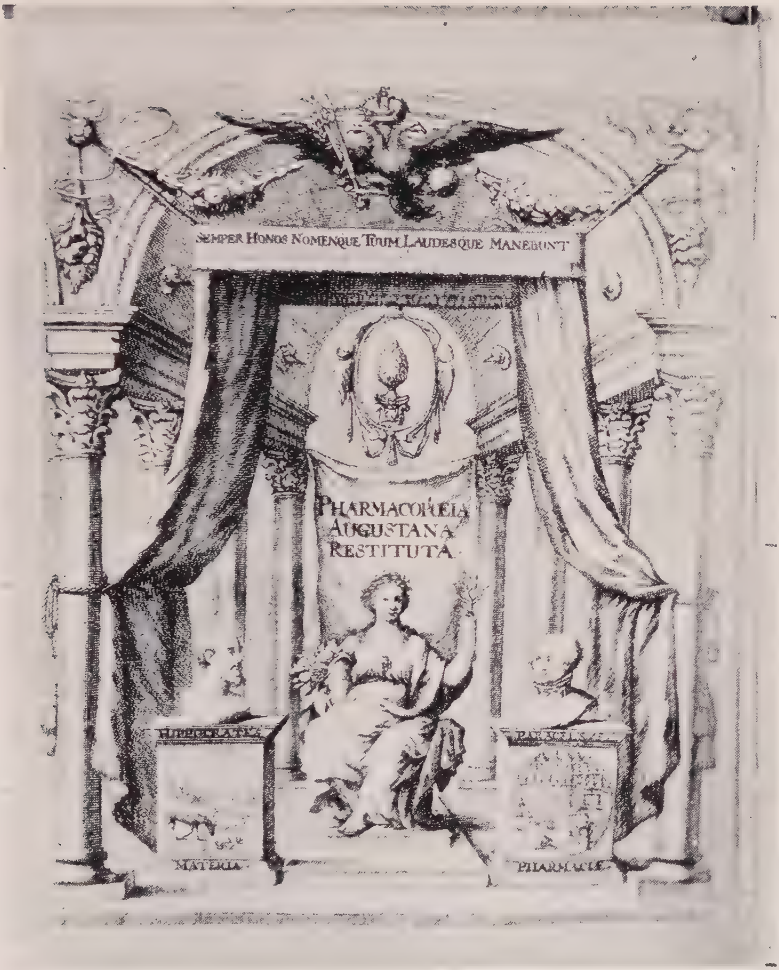


FIG. 35.—TITLE-PAGE OF *Augsburg Pharmacopoeia*, EDITION OF 1673. SEE PAGE 273.

ineffectual internal dosing of the regular physicians, while an itinerant quack quickly cured him with a preparation of sulphur applied externally. This made him a violent anti-Galenist, and a devoted disciple of the teachings of Paracelsus.

He then married a wealthy woman and commenced a career of independent scientific investigations which were destined to enrich both chemistry and biology. He believed in the philosopher's stone and in the elixir of life, and spent much of his time searching for a "universal solvent." We wonder how he had expected to keep it if he had succeeded in finding it. His principal chemical achievement was in connection with the discovery or rather identification of carbon dioxide.

He traced this gas through many of its combinations and obtained it from various sources. He named it *gas sylvestre* or the "wild and untamed gas." He coined the word "gas," which had never before been used, in connection with this investigation. His statement upon this subject is as follows: *Hunc Spiritum, hactenus ignotum, novo nomine gas voco.* (I call this spirit, heretofore unknown, by the new word "gas.")

He made many experiments, some of which led to erroneous conclusions, although his work was correctly performed. Here is an example.

He believed the fact that fishes lived in water to be conclusive proof that they were derived from that element, and he essayed to prove by the following experiment, and believed that his proof was unshakable, that plants had the same origin. He carefully planted a willow tree weighing 5 pounds, in 200 pounds of earth in a tub. The plant was carefully watered in a place protected from dust, and grew for a period of five years. He then found that the tree weighed 165 pounds, while the earth had lost only a few ounces, and he concluded that the more than 164 pounds increase in weight had come from the water alone. What a surprise it would have been to him had he known that his famous *gas sylvestre,* invisible and undetectable by him, had played such an important part in misleading him in his conclusions.

While Von Helmont was engaged in the practice of medicine, he originated a liquid preparation of opium which he called *laudanum cydoniatum,* which was a preparation of the drug made with vinegar as the solvent similar to the "black drop" or "Quaker laudanum" of later days.

The early part of the seventeenth century saw the best work of Ben Jonson and William Shakespeare. Jonson's poetry frequently centered around things pertaining to pharmacy and

medicine. His most celebrated poem is *The Alchemist.* It was said of him that he could describe the properties of celebrated nostrums of his time in terms as glowing as those of any patent medicine advertisement of the late Victorian period.

Perhaps he helped Ludovico Locatelli to believe in his own remedy, which he did to his sorrow. Locatelli was an Italian alchemist, author of *Theatro Arcani.* He was better known as the inventor of a celebrated balsam known throughout Europe as *balsamum Locatelli.* This was considered as a specific for the plague. Its originator died of the plague in 1657.

The most famous chemist of the seventeenth century was Robert Boyle, who is known as the Father of Modern Chemistry. He was born in 1627, and was the seventh son of the Earl of Cork. Among his contemporaries were Sir Isaac Newton, whose work will be referred to later; Christopher Wren, the architect who designed St. Paul's Cathedral, the towers of Westminster Abbey, Greenwich Observatory, and other noted structures; John Milton, the blind poet, author of *Comus, L'Allegro, Il Pensieroso, Paradise Lost,* and other classics; and John Bunyan, the son of a tinker and the author of *Pilgrim's Progress.*

Boyle's early education was obtained at Eton College and he later traveled on horseback

through Europe with a tutor. In 1654 Boyle went to Oxford with a group of intellectuals of his time, who called themselves the "Invisible College," and who applied themselves to experimental science. It was out of this group that the Royal Society of London originated and was incorporated by Charles II in 1663. To become a Fellow of this Society today is a distinction conferred only upon great scientists.

Boyle, while at Oxford, became acquainted with Robert Hooke, a mathematician and physicist, who was one of the charter members of the Royal Society and who attained distinction as an authority upon combustion in his work *Micrographia.* Hooke, in turn, had a disciple in the person of John Mayow, an Oxford student, who was a lawyer and a physician, but who devoted much of his energy to the investigation of the phenomena of combustion. It was Mayow who first recognized the existence of oxygen, which he called *spiritus nitroœreus,* but was unable to isolate. Mayow also attained distinction by devising the pneumatic trough for the collection and study of gases, and to be the first experimenter to distinguish the varying density of gases. The work of neither Hooke nor Mayow was recognized by contemporary scientists and they had to

wait over a century for its utilization and appreciation of its value.

When Boyle was but thirty-five years of age he published his most valuable work, which was aptly named *The Sceptical Chemist.* Boyle's principal work was concerned with experiments upon the elasticity of the air. Evangelista Torricelli, an Italian philosopher and pupil of Galileo, had, earlier in the same century, invented the mercurial barometer, and Otto von Guericke, a burgomaster at Magdeburg, was engaged in inventing the air pump at about this same period, while Denis Papin, the French physician and philosopher, was actually working with Boyle at Oxford when he made the first application in history of steam to the raising of a piston.

Even the best of the scientists of that time had their weak spots. Boyle's was pharmacy and medicine. I have in my collection a book of Boyle's entitled "*Medicinal Experiments or a collection of Choice and Safe Remedies,* for the most part simple and easily prepared: Useful in families and very serviceable to country people. By the Honourable R. Boyle, Esq., Fellow of the Royal Society:" (See illustration No. 40, opposite p. 354.)

Containing about three hundred Receipts, published from the Author's original manuscripts, and by him recom-

mended to the care of his executors, and to be perused by some of his learned friends. Together with a large preface written by the Author's own hand. London, 1693.

The preface starts:

Though physick be not my profession yet I hope this small collection of Receipts will not incur the censure of Equitable and Charitable Persons though diverse of them are professed Physicians, since I was induced to do what I had done by the dictates of philanthropy and Christianity, etc.

Let us look at these receipts. The first is "No. 1. A powerful remedy for Apoplectic Fits." It reads:

Take the herb Mastick and distil by an alembick with a copper body an essential oyl, of which with such a pipe or quill, that one end may be opened or stopped at pleasure (the other still remaining open) blow up some drops, first into one of the patient's nostrils, and after a while into the other.

The inference from this receipt, if it was really a family medicine book, is that every family had a still in those days.

Let us now look at one from the middle of the book: "No. 147. A Choice Remedy for the Pain of the Hemmorrhoids."

Take *Album Græcum* (look this up, ye moderns, for Sir Robert uses the vernacular), reduced to an impalpable powder, mixing it up with a sufficient quantity of goose

grease, and by grinding it up well in a Leaden mortar, reduce it to a black Oyntment, to be applied moderately warm to the part affected.

Let us now take No. 268:

Against Epilepsies or the Falling Sickness. Take of the powder of the true mistletoe of the oak, as much as will lie upon a sixpence, early in the morning, in black cherry water, for some days near the full moon.

It will shock admirers of Boyle, probably, to read these recipes, and realize how fallible he must have been in matters of pharmacy and medicine, for the book, as a whole, is a hodge-podge of superstition which in these days would excite ridicule.

Boyle, while at Oxford, not only came into contact with Hooke and Papin but also worked with Isaac Newton. Boyle's law was the principal outcome of this work at Oxford. He also launched the first sucessful attack upon the old idea, amplified by Paracelsus, that earth, air, fire, and water were elemental substances. He paved the way for Dalton in this statement:

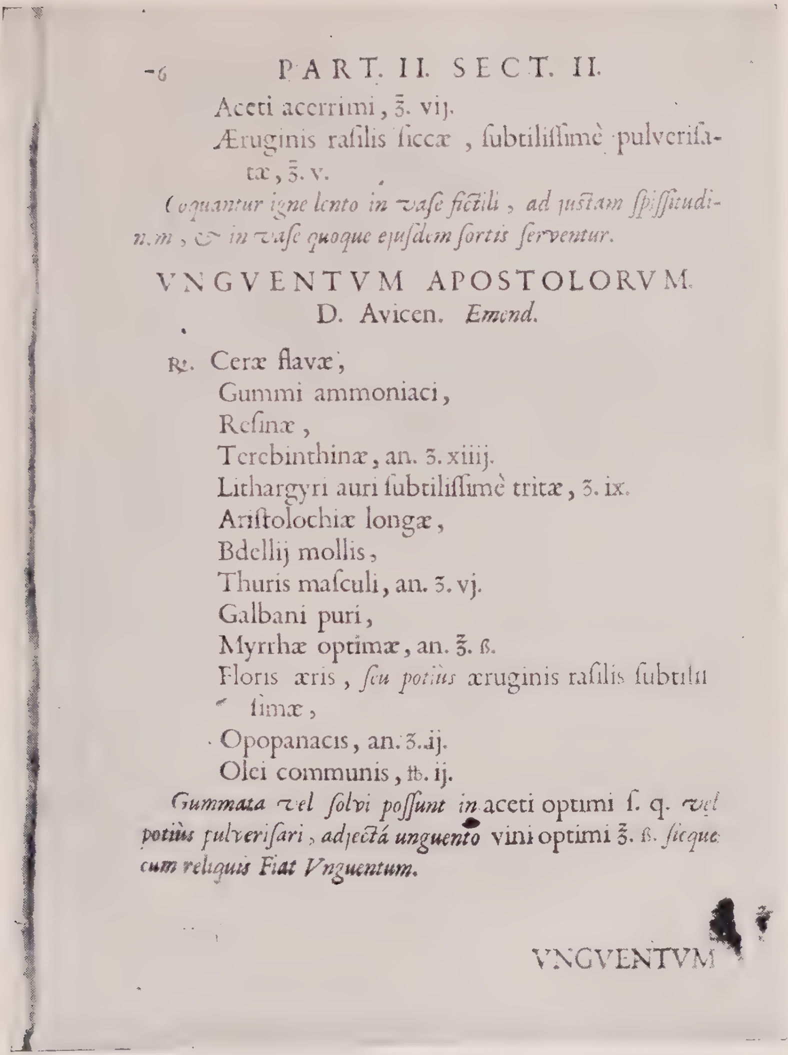
I mean, by elements, as those chymists that speak plainest, do by their principles, certain primitive and simple, or perfectly immingled bodies; which not being made of any other bodies, or of one another, are the ingredients of which all those called perfectly mixt bodies are immediately

compounded, and into which they are ultimately resolved. . . . I look upon earth and water as component parts of the universe or rather of the terrestrial globe, not of all mixt bodies.

Another of the galaxy of famous English scientists who distinguished themselves in the latter part of the seventeenth century was Robert Hooke, the microscopist and physicist. He collaborated with Boyle in the building of an air pump which was a great improvement over that of Von Guericke, with which his classical experiments were made upon the vacuum. Hooke was the first physicist to point out that problems of planetary motion were purely those of mechanics and thus paved the way for Newton, whose *Principia* was published a few years thereafter.

In Hooke's most celebrated work, the *Micrographia,* he described his observations with the newly invented microscope, which he had improved by compounding the lenses so as to give greater magnification. Another of his notable contributions was the invention of the balance wheel, that portion of the mechanism which differentiates the modern watch from the clock.

He may be said to have made the wrist watch safe for humanity, for the watches prior to the time of Hooke were so large and so thick that they were called " Nuremberg eggs."



–6 PART. II. SECT. II.

Aceti acerrimi, ℥. vij.

Æruginis raſilis ſiccæ, ſubtiliſſimè pulveriſatæ, ℥. v.

Coquantur igne lento in vaſe fictili, ad juſtam ſpiſſitudinem, & in vaſe quoque ejuſdem ſortis ſerventur.

VNGVENTVM APOSTOLORVM.
D. Avicen. *Emend.*

℞. Ceræ flavæ,
Gummi ammoniaci,
Reſinæ,
Terebinthinæ, an. ʒ. xiiij.
Lithargyri auri ſubtiliſſimè tritæ, ʒ. ix.
Ariſtolochiæ longæ,
Bdellij mollis,
Thuris maſculi, an. ʒ. vj.
Galbani puri,
Myrrhæ optimæ, an. ℥. ß.
Floris æris, *ſeu potiùs* æruginis raſilis ſubtiliſſimæ,
Opopanacis, an. ʒ. ij.
Olei communis, ℔. ij.

Gummata vel ſolvi poſſunt in aceti optimi ſ. q. *vel potiùs pulveriſari, adjectâ unguento* vini optimi ℥. ß. *ſicque cum reliquis Fiat Vnguentum.*

VNGVENTVM

Fig. 36.—Page from the *Lyons Pharmacopoeia* of 1674, showing a formula for "Apostolic Ointment," credited to Avicenna. See page 120.

In England one of the interesting characters of the seventeenth century was Nicholas Culpeper. He attained distinction by the boldness with which he criticized the early editions of the *London Pharmacopœia.* An example of his style of writing and the fearlessness of his views is found in his criticism of a formula for *mel helleboratum, P. L.* The formula called for three pounds of hellebore infused in fourteen pounds of water for three days, boiled to half its bulk, strained, added to honey and again boiled until the consistence is that of honey. Culpeper comments as follows:

> What a *monstrum horrendum,* horrible, terrible recipe have we got here:—A pound of white hellebore boiled in fourteen pounds of water to seven. I would ask the College whether the hellebore will not lose its virtue in the twentieth part of this infusion and decoction (for it must be infused, forsooth, three days to a minute) if a man may make so bold as to tell them the truth. A Taylor's Goose being boiled that time would make a decoction near as strong as the hellebore, but this they will not believe. Well, then, be it so. Imagine the hellebore still remaining in its vigour after being so long tired out with a tedious boiling (for less boiling would boil an ox), what should the medicine do? Purge melancholy, say they. But from whom? From men or beasts? The devil would not take it unless it were poured down his throat with a horn. I will not say they intended to kill men, *cum privilegio;* that's too gross. I charitably judge them. Either the virtue of the hellebore

will fly away in such a martyrdom, or else it will remain in the decoction. If it evaporate away, then is the medicine good for nothing; if it remain in it is enough to spoil the strongest man living. (1) Because it is too strong. (2) Because it is not corrected in the least. And because they have not corrected that, I take leave to correct them.

Culpeper issued several pharmacopœias of his own and although without any regular education as such, called himself a physician and attained prominence as a practitioner as well as an author. He was an apothecary's apprentice at Bishopgate and probably gained his knowledge of drugs from this source.

One of Culpeper's contemporaries was a sort of botanical mystic named Robert Turner, and between the two of them, independently aided by Oswald Crollius, who preceded them by a few years, they succeeded in reviving the almost forgotten idea of signatures, which had been a factor in the days of Pliny and to a lesser extent during the Arabian period, and which had been partly revived by Paracelsus. Turner confused the issue with the idea of Divine intent and wrote:

God hath imprinted upon the plants, herbs, and flowers, as it were in hieroglyphics, the very signature of their virtues.

The Doctrine of Signatures (see illustration No. 25, opposite p. 210), as this belief came to be

called, professed to find resemblances either between the plant and the cause of the disease, as in the names " feverwort," " boneset," etc., or between the plant and the part of the body affected, as in " liverwort," " heartsease," etc. Many of our common plant names still reflect this curious superstition.

Some of the elaborate seventeenth century applications of this doctrine are amusing in the extreme, as is shown by the following one concerning walnuts, taken from an old herbal:

> Walnuts have the perfect signature of the head: the outer husk or green covering represents the pericranium or outward skin of the skull, whereon the hair groweth, and, therefore, salt made of those husks or barks is exceedingly good for wounds in the head. The inner woody shell hath the signature of the skull, and the little yellow skin or peel that covereth the kernell is like the thin scarf that envelopes the brain and therefore it is very profitable for the brain and resists poisons, for if the kernell be bruised and moystened with the quintessence of wine and laid upon the crown of the head it comforts the brain and head mightily.

Astrological relationships between plants and stars, as quoted from Pliny's time, had their chief exponent in Nicholas Culpeper, who in the preface to his herbal says:

> First—consider what plant causeth the disease.
>
> Second—consider what part of the body is afflicted by the disease.

Third—consider by what planet the afflicted part of the body is governed.

Fourthly—You have in this book the herbs for cure appropriated to the several diseases whereby you may strengthen the part of the body by its like, as the brain by herbs of Mercury, the breast and liver by herbs of Jupiter, and the heart and vitals by herbs of the Sun, etc.

Kipling evidently drew much of the inspiration and information for his *Fathers of Old* from Culpeper, for this curious volume is full of the virtues of "Alexanders and marigolds, eyebright, orris and elecampane," and where Kipling says,

> " Who but Venus should govern the rose
> Who but Jupiter own the oak? "

he quotes almost verbatim, for in Culpeper's book it is said of the rose " damask under Venus," and under the oak " Jupiter owns the tree."

Oswald Crollius wrote a *Tractatus de Signaturis* in which he describes himself as *Medicus et Philosophicus Hermeticus.* This work is entirely devoted to a discussion of these supposed relationships between color or form and therapeutic efficiency and also deals extensively with the influence of the heavenly bodies on substances of animal, vegetable, and mineral origin.

Giovanni Batista Porta was a contemporary of Crollius and like him was a medical mystic who dealt with the occult characters of medicines. He

was on the border line between the sixteenth and seventeenth centuries and works of his appeared in both of these periods. His *Magia Naturalis* is his most noted work.

Quite in keeping with the superstitions connected with the Doctrine of Signatures was the revival of the idea of "sympathetic remedies," as exemplified by the *unguentum armarum* of Paracelsus to which reference was made in the previous chapter. These remedies constituted a form of absent treatment for wounds which was so different from the scientific and often unsanitary methods of treatment, even up to the time of Pasteur and Lister, that there is little wonder at the esteem in which they were held, although we may indulge in a quiet smile at the curious hypotheses which were published to account for their efficacy. The treatment in brief was this:

The wound itself received no treatment except washing in clean, cold water, and bandaging with clean linen; the bandage was not to be removed for some days. The remedy was applied to the weapon which had caused the wound. It is important to note that the treatment would not answer if an artery had been severed, or if the brain, heart, or other internal organs had been injured. Paracelsus was the author of one of these sympathetic remedies which was in the form

of an ointment. His theory of the treatment was that the anointment of the weapon acted upon the wound by a magnetic current through the air to the healing balsam. This preparation came to be known as the Paracelsan Weapon Salve, or *Unguentum Armarum*.

Another " sympathetic " preparation, which was in the form of a powder, was that of Sir Kenelm Digby (see illustration No. 27, opposite p. 224). He was an unusual character of the seventeenth century, the son of one of the leaders of the Gunpowder Plot, who seems to have lived down the stigma of his father's execution. He was very popular with King James I, whom he pressed for a commission to wage war against the Spaniards and capture some of their rich galleons. The Lord High Admiral, whose signature was needed to make such a commission legal, being absent when Sir Kenelm was ready to sail, he was granted a " license to undertake a voyage for the increase of his knowledge." He evidently started in with the idea of completing a post graduate course as well, for he spent several years in the Mediterranean capturing French, Spanish, and Flemish ships, and finally defeated the combined fleets of the French and Venetians at Scandaroon in Asia Minor, north of Antioch, after which he returned to England, was knighted, changed his

religion several times, was imprisoned and banished at intervals, during all of which period he devoted himself to science, and finally published a book on what he called the "Sympathetic Powder," which consisted of powdered copperas, or green vitriol. His explanation of the effect of the powder was that "the rays of the sun extracted from the blood and the vitriol associated with it, the spirit of each in minute atoms. These combined, and the air charged with the atoms of blood and vitriol were attracted to the wound and effected the cure."

An example of one of the cases is interesting, as quoted from Wootton's *Chronicles of Pharmacy*. A carpenter had cut himself severely with an axe. The offending axe, still bespattered with blood, was treated with the remedy and hung up in a cupboard. The wound progressed satisfactorily, but one day it suddenly became violently painful. On investigation it was found that the axe had fallen from the nail on which it had been hung.

In the National Portrait Gallery Sir Kenelm Digby's portrait has attached to it a plate on which is inscribed the statement that he was "a prodigy of learning, credulity, valor, and romance." He must have been a compelling character, for one of his contemporaries pays him

the unusual tribute of saying "He was such a goodly person, gigantic, and of great voice and had so graceful elocution and noble address, that had he been dropt out of the clowdes in any part of the world he would have made himself respected."

In Hudibras are several references to the "sympathetic powder:"

"For by his side a pouch he wore
Replete with strange hermetic powder,
That wounds nine miles point blank would solder
By skilful chemist at great cost
Extracted from a rotten post."

And

"'Tis true a scorpion's oil is said
To cure the wounds the vermin made;
And weapons dressed with salves restore,
And heal the wounds they made before."

Sir Walter Scott also alludes to this remedy in the Lay of the Last Minstrel in the following lines:

"But she has ta'en the broken lance,
And washed it from the clotted gore,
And salved the splinter o'er and o'er."

Dryden has also introduced the same superstition in his Enchanted Island. Act V Scene II.

Ariel. Anoint the sword which pierced him with this
Weapon salve, and wrap it close from air
Till I have time to visit it again.

Again in Scene IV, Miranda enters with Hippolito's sword, wrapt up:

Hip. O, my wounds pain me,
[She unwraps the sword.]
Mir. I am come to ease you.
Hip. Alas I feel the cold air come to me;
My wound shoots worse than ever.
Mir. Does it still grieve you?
[She wipes and anoints the sword.]
Hip. Now, methinks, there's something laid just upon it:
Mir. Do you find no ease?
Hip. Yes, yes; upon the sudden all this pain
Is leaving me—Sweet Heaven, how am I eased!

In the seventeenth century began the practice of medicine and pharmacy in America. In 1603 Elizabeth, Queen of England, was succeeded by James I, during whose reign the apothecaries had attained their independence and the first London Pharmacopœia had been issued. In 1607, Jamestown, Virginia, was settled by the English; in 1608 Quebec was founded by the French; in 1609 Hendrik Hudson sailed up the river which still bears his name. In 1614 Manhattan was colonized by the Dutch, and in 1620 the Pilgrim Fathers landed on the "stern and rock bound coast" of Massachusetts. The "melting pot" had received its first ingredients.

There were some few educated physicians and apothecaries in each of these settlements, but for the most part the practice of medicine consisted of empiricism and the following of Indian folk lore. No encouragement or recognition of professional or other education was given by any of these local colonies, nor by their old world sponsors, neither was there any restriction as to who might practice. In the colonies under Spanish and French influence, the priests, and particularly the Jesuits, were the most important factor in the development of pharmacy and medicine.

Ponce de Leon, in his search for the Fountain of Youth in the new world, had discovered Florida nearly a century before Jamestown was settled, but no permanent colonization of the Gulf or southwestern States took place until the following century. Nicholas Monardes, a scientist who explored many parts of the new world, especially in the West Indies, had established a museum of American products in his native city of Seville, which did much to popularize the use of some of the new world drugs which have already been mentioned, and others as well.

The French sent the first trained pharmacist to America in the person of François Gilead, who was apothecary on the ship of Jacques Cartier,

FIG. 57.—PICTURE OF DR. FRIEDRICH HOFFMANN, FROM FRONTISPIECE OF HOFFMANN'S *Clavis Pharmaceutica Schroederiana*, 1675. SEE PAGE 361.

who had discovered the St. Lawrence River and settled Mount Royal (now Montreal) in the previous century. Another French apothecary, Louis Hébert, arrived early in the seventeenth century and established himself at Port Royal on the Bay of Fundy. Both he and his successor, Giffard, made their principal livelihood as tillers of the rich soil of the new world.

Among the Jesuit missionaries and explorers who were physicians and pharmacists or who familiarized themselves with Indian medical lore later during the eighteenth century, were Charles Boispineau, Jean François Parisel, Louis Hennepin, and LaSalle; the latter took possession of a great territory, which he named Louisiana, in honor of his sovereign, Louis XIV.

The few laws that were passed during this century in the Colonies were mainly concerned with infectious diseases and control of surgery and midwifery. Few of these acts were enforced and they soon passed into oblivion. One of the historians has said of the latter part of the seventeenth century:

> Anyone who knew calomel from tartar emetic, and jalap from ipecac, and had the assurance to use them, who could make and apply ointments and plasters, dress wounds or splint a broken limb, was a welcome settler and received the title of doctor without asking.

Dr. Samuel Fuller, one of the passengers on the Mayflower, became an eminent medical practitioner in Plymouth and indeed all through Massachusetts. His better half was a celebrated midwife in the community, so between them they covered the professional needs of that colony pretty well.

Giles Firmin, an English apothecary, was another Mayflower passenger, who turned his attention to, and became eminent in medicine. He turned later to religion and went back to England and was ordained as a minister. Several eminent theologians and presidents of Harvard in its early days, Doctor Chauncey and Doctor Hoar, among others, became noted medical practitioners in Boston and its environs.

One authority says that in Massachusetts "pharmacy was largely in the hands of Indians, schoolmasters, old women, and clergymen." These latter were frequently skilled apothecaries who had learned pharmacy as a means of livelihood during periods of persecution, and practiced it as a means of subsistence in the intervals of preaching. One of these, the Reverend Jacob Green, was the factotum of his community, for besides being a minister, he was a lawyer, schoolmaster, miller, physician, distiller and apothecary.

In 1646 the first store devoted distinctly to pharmacy in Boston was opened by William Davies. In New Jersey, which was under the jurisdiction of the Duke of York, an attempt was made in 1664 to regulate the practice of apothecaries, with penalties for injury due to malpractice, showing that pharmacy and medicine were both practiced by the same individual in this community.

In Virginia the legal enactments were largely directed in the early part of the seventeenth century, at the regulation of the fees of surgeons and apothecaries. Prominent among the surgeons and apothecaries of this colony was Dr. Edward Heldon, who had been a friend of Shakespeare and pall bearer at his funeral.

New Amsterdam, which name was changed to New York in 1664, enjoyed the services of a celebrated German physician, Dr. Hans Kierstede, who married a prominent and wealthy midwife of Dutch descent named Annetje Jansen. This couple became the ancestors of many celebrated pharmacists of the succeeding centuries, one of whom, Henry T. Kierstedt, was President of the American Pharmaceutical Association in 1860 and 1861, for two successive terms.

In 1652 a turmoil in the medical profession

of Manhattan was publicly disclosed in a petition on the part of the surgeons of New Amsterdam asking that "none but they alone be allowed to shave the director and council." It appeared that the cause of the petition was the fact that the barber surgeons of vessels lying over in the port cut into their tonsorial trade. Tonsorial perfection rather than tonsillectomies seemed to be the goal toward which the surgeons strove at that time.

The social position of the physician was very low in New York at that time as evidenced by the fact that no physician is mentioned in a list of "great citizens" in the town's census of 1657, while the leading physician of that day, Dr. Jacob H. Varvanger, is listed among the "small citizens." In 1691 Dr. Johannes Kerfbyr, a Dutch physician and surgeon, performed what was probably the first official autopsy in the new world, when Governor Slaughter of New York died under suspicious circumstances.

Dr. Jacob Belkamp and Dr. William Beltsnyder are mentioned in the early history of New York as apothecaries of that period. In New York proper, quacks became exceedingly numerous and attempts were made to divorce pharmacy from medicine. One of the popular works in this colony in the latter part of the seventeenth cen-

tury, and also throughout the greater part of the eighteenth century, was Salmon's *Herbal,* originally printed in London in 1676. This was a popular exposition of medicine and pharmacy which took the place of a college course as a means of learning both of these arts.

When Peter Minuit settled Delaware in 1638, calling it New Sweden, an early physician member of the colony was Otto Ernst Koch of Holstein.

In William Penn's "good ship Welcome" there came a noted physician, Dr. Thomas Wynne, a Quaker like Penn. Penn evidently did not pin his faith to professional medicine, for he brought with him a popular medical book, which as "Penn's Dispensatory," (see illustration No. 33, opposite p. 288), is in the collection of the Philadelphia College of Pharmacy and Science, with annotations in the hand of the owner and embellished with his bookplate.

In England, during the latter part of the seventeenth century, there appeared many nostrums and proprietaries. Among these were Anderson's Scots Pills, Haarlem Oil, and *Baume Tranquille.* This was the period, too, in which "patent medicines" originated. The term originally meant remedies that were actually pro-

tected by letters patent, for the so-called patent medicines of today are simply nostrums of proprietary origin in which there is no accountability for either nature or uniformity of composition, to any authority whatever, nor any legal control or supervision of their manufacture.

The first medicine to be actually patented in Great Britain was "Goddard's Drops." An advertisement of this preparation which appeared in the London Gazette of 1673 reads as follows:

> These are to give notice, that the eminently sucessful medicine commonly known by the name "Dr. Goddard's Drops" are now most faithfully prepared by Dr. C. Goddard, to whom the said medicine and method of using was long since communicated by Thomas Goddard, Esq., nephew to the said Doctor Goddard, to whom alone (except to His Majesty) the whole receipt of making the medicines was communicated. The said medicine having been these twelve months in preparing is now to be had in St. John's Close at the house where Doctor Goddard lived and died, being next door to the Star in the Passage to Clerkenwell.

What was this celebrated nostrum of this period, the prototype of thousands of secret remedies of today? Charles II of England, thinking to benefit humanity by enabling physicians generally to have access to the formula for this exceedingly popular and successful remedy of its time, purchased the formula from Dr. God-

dard for a sum which was said to be $25,000 or more. The published formula as it appeared in Bates Dispensatory, edited by the celebrated Dr. Salmon, was as follows:

℞ Human bones or rather scales, well dryed, brake them into bits, and put them in a retort, and joyn thereto a large receiver which lute well; and distil, first with a gentle fire, then with a stronger, increasing the fire gradation; so will you have in the recipient a flegm, spirit, oyle and volatile salt. Shake the receiver to loosen the volatile salt from the sides, then close your receiver, and set it in the earth to digest for three months. After that digest it at a gentle heat for fourteen days, then separate the oyle which keep for use.

Salmon adds:

If you want it for gout of any particular limb it is better to make it from the bones of that limb. The dose is six to twelve drops, but it has an evil scent. You can, however, correct that and elixirate the preparation bringing it even to a fragrancy if you add so much Spirit of Nitre as will dissolve the oil, and then mix it with four times its weight of Spirit of Wine. Then you should give twenty to sixty drops in a glass of Canary. So you will have a medicine beyond all comparison ten times exceeding the other in worth and efficiency.

This preparation, made as above, had a vogue in the medical practice of the time under the name *sal volatile oleosum,* which name was given it by Sylvius.

Another formula which was given for God-

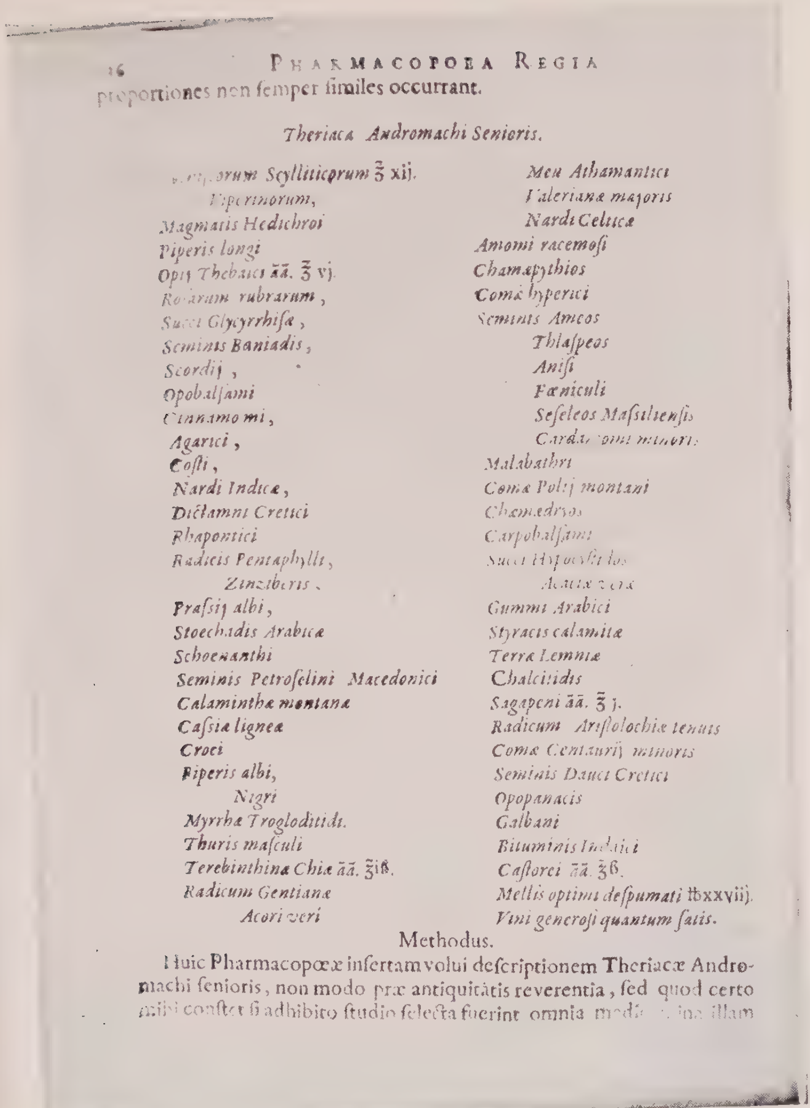
dard's Drops called for hartshorn, portions of the skull of a criminal who had been hanged, dried vipers' bodies and other unmentionable substances.

A London apothecary's advertisement of about 1685 reads as follows:

Ambrose Godfrey Hanckwitz, chemist in London, Southampton Street, Covent Garden, continues faithfully to prepare all sorts of remedies, chemical and galenical. He hopes that his friends will continue their favours. Good cordials can be procured at his establishment, as well as Royal English Drops, and other articles such as Powders of Kent, Zell, and Contrajerva, Cordial red powder, Gaskoins powder, with and without bezoar, English smelling salts, true Glauber's salts, Epsom salt, and volatile salt of ammonia, stronger than the former. Human skull and hartshorn, essence of ambergris, volatile essence of lavender, musk and citron, essence of viper, essence for the hair, vulnerary balsam, commendeur balsam for apoplexy, red spirit of purgative cochlearia, spirit of white cochlearia, and others. Honey water, lavender water of two kinds, Queen of Hungary water, orange flower water, arquebusade.

For the information of the curious, he is the only one in London who makes inflammable phosphorus, which can be preserved in water. Phosphorus of Bolognian stone, flowers of phosphorus, black phosphorus, and that made with acid oil, and other varieties. All unadulterated. Every description of good drugs he sells, wholesale and retail.

Solid phosphorus, wholesale, 50*s*. an ounce, and retail, £3 sterling, the ounce.



proportiones non semper similes occurrant.

Theriaca Andromachi Senioris.

Trochiscorum Scylliticorum ℥ xij.
Viperinorum,
Magmatis Hedichroi
Piperis longi
Opij Thebaici ā̄ā. ℥ vj.
Rosarum rubrarum,
Succi Glycyrrhisæ,
Seminis Baniadis,
Scordij,
Opobalsami
Cinnamomi,
Agarici,
Costi,
Nardi Indicæ,
Dictamni Cretici
Rhapontici
Radicis Pentaphylli,
Zinziberis.
Prassij albi,
Stoechadis Arabicæ
Schoenanthi
Seminis Petroselini Macedonici
Calaminthæ montanæ
Cassiæ ligneæ
Croci
Piperis albi,
Nigri
Myrrhæ Trogloditidi.
Thuris masculi
Terebinthinæ Chiæ āā. ℥iß.
Radicum Gentianæ
Acori veri
Meu Athamantici
Valerianæ majoris
Nardi Celticæ
Amomi racemosi
Chamæpythios
Comæ hyperici
Seminis Amcos
Thlaspeos
Anisi
Fœniculi
Seseleos Massiliensis
Cardamomi minoris
Malabathri
Comæ Polij montani
Chamædryos
Carpobalsami
Succi Hypocistidos
Acaciæ veræ
Gummi Arabici
Styracis calamitæ
Terræ Lemniæ
Chalcitidis
Sagapeni āā. ℥ j.
Radicum Aristolochiæ tenuis
Comæ Centaurij minoris
Seminis Dauci Cretici
Opopanacis
Galbani
Bituminis Iudaici
Castorei āā. ʒß.
Mellis optimi despumati ℔xxviij.
Vini generosi quantum satis.

Methodus.

Huic Pharmacopœæ insertam volui descriptionem Theriacæ Andromachi senioris, non modo præ antiquitatis reverentia, sed quod certo mihi constet si adhibito studio selecta fuerint omnia medicamina illam

FIG. 38.—PAGE FROM THE *Pharmacopoeia Regia Galenica*, 1684, BY MOSES CHARAS, SHOWING POLYPHARMACAL FORMULA FOR THERIAC. SEE PAGE 307.

Early in the seventeenth century botany was also one of the subjects in which pharmacists were greatly interested. Illustrated works on the subject became necessary because the classifications of Cæsalpinus of the sixteenth century were not satisfactory nor were printed descriptions alone adequate for proper identification. It will be readily understood, therefore, that all of our knowledge of plants and vegetable drugs up to within one hundred and fifty years ago, when Linnæus originated the first satisfactory system of classification and identification, is entirely dependent upon the recognition of the synonym or common name and it is for that reason that the exact identity of many plants and drugs referred to by early writers is involved in uncertainty.

In Nuremberg, in about 1670, the pharmacists and physicians joined in botanical excursions which were known as "herbations," and which were for the purpose of describing and classifying all plants found and for the investigation of their peculiar medicinal properties. These herbations usually concluded with a banquet which was indicative of the customs of the period and of the capacities of these members of the medical and pharmaceutical professions, if the following authentic bill from the Archives of the Nuremberg College of Pharmacy is any criterion:

To Mr. Wurfbain's Herbation, May 16, 1698, at which nineteen persons were present.

2 Dishes stew	Florin,	3.20
2 Meat pies, 12 chickens and veal	Florin,	7.40
2 Dishes, 3 sour tongues	Florin,	1.48
1 Dish, 8 lbs. fish	Florin,	2.40
1 Dish, 6 geese	Florin,	3.36
2 Dishes, 12 chickens	Florin,	4.48
1 Dish. 2 rabbits and 10 wild ducks	Florin,	4.14
2 Dishes, 36 cheese cakes	Florin,	1.12
2 Dishes, lobsters	Florin,	1.44
2 Dishes, hop balls	Florin,	1.36
1 Westphalian ham	Florin,	2.00
Collation	Florin,	3.00
Wheat and rye bread	Florin,	.46
1 Barrel of wine and 1 pail	Florin,	24.48
Waiter	Florin,	.45
2 Dishes of asparagus	Florin,	1.44
6 Plates of raddish	Florin,	.24
	Florin,	62.45

Christoph Zinnerer,
Wine Merchant.

N. B.—Together, 19 persons. Makes for each person, 4 Florin and 4 Kreuzer.

In figuring out the per capita cost, the arithmetic seems to be a little unsteady, but a slight overcharge in a banquet of this kind would not amount to much, considering that the equivalent of a florin in our money is about fifty cents.

The education of the pharmacist at this time

in Germany and Belgium was based largely upon his apprenticeship, which required some initial preparation and education, especially in Latin, and which lasted for five or six years, and entitled the student at the completion of this period to a certificate of proficiency as a "Journeyman Apothecary."

This journeyman apothecary was usually required to pass an examination and take an oath that he "will faithfully serve, not only his master, but also the community at large. That he will prepare all medicines *secundum artem* and of pure drugs, whether they be those which are annually examined by the authorities or not. That he will dispense no poison opiate or emmenagogue without the knowledge of the master nor endanger the life of any one by his carelessness. That he will not deliberately change a physician's prescription. That he will abstain from excessive indulgence in intoxicating drinks and will at all times set a good example to the apprentice."

When he wished to become a proprietor he had to pass another examination.

That all was not roseate for the proprietor in some localities, even after overcoming all of these obstacles, is found in the fact that in the seventeenth century in Nuremberg, the apothecaries had the temerity to wear military coats and

swords like the doctors, and as their fellow members in Frankfort, Strasburg, Vienna, etc., were accustomed to do. They were prevented from doing so by the police, whereupon they petitioned to the Council for the privilege, stating for their reasons that " Many of our brethren have matriculated at universities, some have attended academies and others have even graduated as doctors. We consider that our profession is not a trade but is in reality a free art."

In 1683 a dissension arose between the physicians and apothecaries in Belgium and the latter came out victorious, for in Bruges a law was passed preventing physicians from dispensing their own remedies under heavy penalties.

The apothecaries were frequently made the target for satirical or abusive articles, among which was one by Moscherosch, who says, among other things:

> The *medicamentia purgantia* are the genuine fire of purgatorium; the barbers are the devils, and the drug shop is a diminutive Hades, whilst the patient represents the poor lost condemned soul. The druggists display in their shops, slips of paper covered with strange and wonderful hieroglyphs that no one can decipher. The directions on these papers are universally preceded by Rec. which in fact stands for *per decem,* and means that one prescription out of ten may help, or, more properly speaking, that, of ten

patients, one may escape. They call common drugs by strange names to tempt the patients' curiosity and induce him to pay an extra price for the same. Their mixtures are frequently so loathsome as to taste and odor that one would expect to see the worst disease leave the body in haste to escape the contamination.

Another enemy of the profession at this period was an unknown author of a book called *Description of All Professions and Trades,* published in 1699, in which he says:

> One frequently finds in the shops superannuated drugs that are more harmful than beneficial to the patient. This results from a habit they have of buying, at a cheap price, goods that have been kept in stock at some grocer's from time immemorial and that smell worse than Lazarus in his grave. Then, too, you will meet frequently with a druggist who knows nothing about any krout (herb) except it be the sour kind which he will recognize when it is cooked. Then again he will make more mistakes than the children of the prophet in the days of Elisha who gathered in bitter colocynth in place of healing herbs.

The pharmaceutical and chemical progress of the seventeenth century, which has just been outlined, shows remarkable advances over that of the preceding century. This is partly due to the work of a half dozen individuals who were either supermen of science in general or who were the authors of epoch-making discoveries. This list includes Francis Bacon, Galileo Galilei, René

Descartes, Isaac Newton, William Harvey, and Antony Leeuwenhoek.

Francis Bacon, born in 1561, was a product of Cambridge. He was a lawyer, ambassador, statesman, essayist, philosopher, prophet, and scientist. He lived in that golden age of literature whose spokesmen were William Shakespeare, Ben Jonson, John Fletcher, Francis Beaumont, and Miguel Cervantes. He is best known by his philosophic work, the *Novum Organum,* and by his essays, which have gone through more than one hundred editions. He attempted the stupendous task of making a complete classification and synopsis of all branches of human learning. His weak points were his ignorance of mathematics, which he despised, and his rejection of the Copernican theory.

Galileo was a pupil of Bruno, who met with such a tragic fate at the close of the fifteenth century. He studied at the University of Pisa and his first important discovery was made while he was attending service in the Cathedral of Pisa. Few modern discoveries are made in a similar environment. Galileo noticed the regularity of the swinging of the great chandelier, suspended by a chain from the high vaulted arch, and the result was the pendulum, and a reformation of clock making.

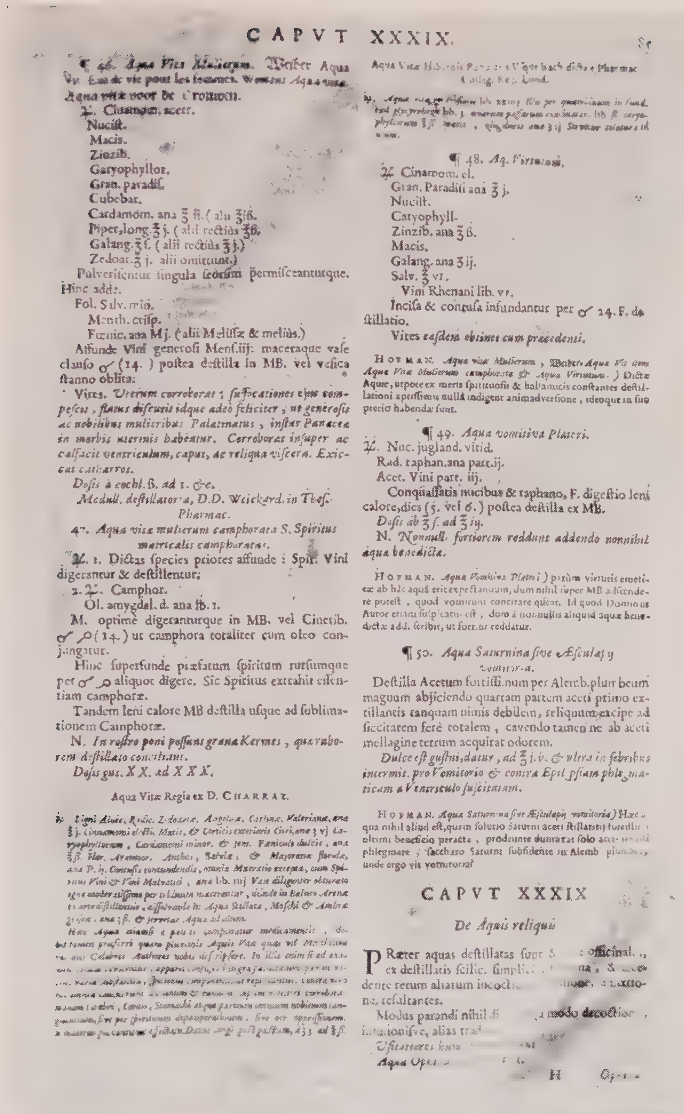
His next important discovery was connected with physics and concerned the law of falling bodies. To his unbelieving associates he planned a demonstration, which took place at the leaning tower of Pisa. From the lower side of the top he released simultaneously a one pound weight and a one hundred pound weight, both of iron. His contemporaries and predecessors had always believed and taught that the velocity of a falling body was proportional to its weight. Every schoolboy knows better than that now. When these weights struck the ground simultaneously it vindicated Galileo's theories and struck consternation to the souls of his critics, for the clank of those weights striking the pavement sounded the death knell of the older systems of philosophy.

Although Galileo was an artist, a musician, an essayist, and a poet, he next became an astronomer through the influence of Bruno and his friendship with Kepler. His first telescope was made by himself in 1609, from information obtained of the work of Lippershey, the optician of Middleburg, Holland, who had already been experimenting along this line.

He presented a telescope to the Doge of Venice, and the Senate of that Republic elected him to a professorship in the University for life. However, he accepted an offer to come to Flor-

ence, a rival city, because he would be free from teaching duties and could devote his time to research, and here his troubles began. In 1611 he visited Rome with his telescope and showed the moon and some of the planets and their satellites to the Pope and his cardinals. It took the Holy See just five years to realize that what they had seen and listened to when Galileo visited them was in disagreement with the orthodoxy of the Church. In 1616 the Pope condemned Galileo's teaching of the sun's fixity and the diurnal motion of the earth as heretical, and the poor astronomer was commanded "not to hold, teach nor defend the condemned doctrine." For seven years Galileo obeyed this mandate. He then recommenced his astronomical observations and calculations and in 1630 published his *Dialogue,* which was a popular exposition of the Copernican theory. This book was immediately condemned by Pope Urban VIII, and Galileo was summoned to Rome, post haste.

He was examined here in secret for over six months. During this time he went through five of the six stages of the ordeal of the Inquisition. These were as follows: 1 and 2. Threat of torture on separate and successive occasions. 3. Entry of the torture chamber. 4. Showing the instruments of torture. 5. Preparation for the



CAPVT XXXIX. 81

¶ 46. *Aqua Vitæ Mulierum.* Weiber Aqua Vit. Eau de vie pour les femmes. *Womens Aqua vitæ.* Aqua vitæ voor de Vrouwen.

♃. Cinamom. acerr.
Nucist.
Macis.
Zinzib.
Garyophyllor.
Gran. paradis.
Cubebar.
Cardamom. ana ℥ ß. (alii ℥ iß.
Piper, long. ℥ j. (alii rectiùs ℥ ß.
Galang. ℥ ſ. (alii rectiùs ℥ j.)
Zedoar. ℥ j. alii omittunt.)

Pulverisentur singula seorsim permisceanturque. Hinc adde.

Fol. Salv. min.
Menth. crisp.
Fœnic. ana M j. (alii Melissæ & meliùs.)

Affunde Vini generosi Mens. iij: maceraque vase clauso ♂ (14.) postea destilla in MB. vel vesica stanno oblita:

Vires. *Uterum corroborat; suffocationes ejus compescit, flatus discutit idque adeò feliciter; ut generosis ac nobilibus mulieribus Palatinatus, instar Panaceæ in morbis uterinis habeatur. Corroborat insuper ac calfacit ventriculum, caput, ac reliqua viscera. Exiccat catharros.*

Dosis à cochl. ß. ad 1. &c.

Medull. destillatoria, D.D. Weickard. in Thes. Pharmac.

47. *Aqua vitæ mulierum camphorata S. Spiritus matricalis camphoratus.*

♃. 1. Dictas species priores affunde: Spir. Vini digerantur & destillentur:

2. ♃. Camphor.
Ol. amygdal. d. ana ℔. 1.

M. optimè digeranturque in MB. vel Cineritib. ♂ ♀ (14.) ut camphora totaliter cum oleo conjungatur.

Hinc superfunde præfatum spiritum rursumque per ♂ ♀ aliquot digere. Sic Spiritus extrahit essentiam camphoræ.

Tandem leni calore MB destilla usque ad sublimationem Camphoræ.

N. *In rostro poni possunt grana Kermes, quæ ruborem destillato conciliant.*

Dosis gut. X X. ad X X X.

Aqua Vitæ Regia ex D. CHARRAZ.

℞ *Ligni Aloës, Radic. Zedoariæ, Angelicæ, Carlinæ, Valerianæ, ana* ℥ j. *Cinnamomi electi, Macis, & Corticis exterioris Citri, ana* ʒ vj *Caryophyllorum, Cardamomi minor. & sem. Fœniculi dulcis, ana* ℥ ß. *Flor. Arantior. Anthos, Salviæ, & Majoranæ floridæ, ana P. ij. Contusis contundendis, omnia Matratio excepta, cum Spiritu Vini & Vini Malvatici, ana* lib. iiij *Vase diligenter obturato igne moderatissimo per triduum macerantur, deinde in Balneo Arenæ ex arte distillantur, affundendo ... Aqua Stillata, Moschi & Ambræ grysea, ana* ℈ ß. *& servetur Aqua ad usum.*

Hæc Aqua etiamsi e ... componatur medicamentis, debet tamen præferri quam pluribus Aquis Vitæ quas vel ... alii Celebres Authores nobis descripsere. In illis enim si ad examen ... apparet ... [illegible] ... Cerebri, Cordis, Stomachi atque partium omnium nobilium ... sive per spirituum depauperationem, sive ... oppressionem ... Datur ... post pastum, à ʒ j. *ad* ℥ ß.

Aqua Vitæ H... Pharmac Colleg. Reg. Lond.

℞. *Aqua vitæ ... lib* xxiiij *... per quatriduum in ... lib.* j. *... lib ß. caryophyllorum* ℥ ß *macis, ... ana* ʒ ij *... [illegible]*

¶ 48. *Aq. Virtutum.*

♃. Cinamom. el.
Gran. Paradisi ana ℥ j.
Nucist.
Caryophyll.
Zinzib. ana ℥ ß.
Macis.
Galang. ana ʒ ij.
Salv. ℥ vi.
Vini Rhenani lib. vi.

Incisa & contusa infundantur per ♂ 24. F. destillatio.

Vires *easdem obtinet cum præcedenti.*

HOFMAN. *Aqua vitæ Mulierum*, Weiber-*Aqua Vit item Aqua Vitæ Mulierum camphorata & Aqua Virtutum.*) Dictæ Aquæ, utpote ex meris spirituosis & balsamicis constantes destillationi aptissimis nullâ indigent animadversione, ideoque in suo pretio habendæ sunt.

¶ 49. *Aqua vomitiva Plateri.*

♃. Nuc. jugland. virid.
Rad. raphan. ana part. ij.
Acet. Vini part. iij.

Conquassatis nucibus & raphano, F. digestio leni calore, dies (5. vel 6.) postea destilla ex MB.

Dosis ab ℥ ſ. *ad* ℥ iij.

N. *Nonnull. fortiorem reddunt addendo nonnihil aquæ benedictæ.*

HOFMAN. *Aqua Vomitiva Plateri*) parùm virtutis emeticæ ab hac aquâ erit expectandum, dum nihil super MB ascendere potest, quod vomitum concitare queat. Id quod Dominus Autor etiam suspicatus est, dum à nonnullis aliquid aquæ benedictæ add. scribit, ut fortior reddatur.

¶ 50. *Aqua Saturnina sive Æsculapii vomitoria.*

Destilla Acetum fortissimum per Alemb. plumbeum magnum abjiciendo quartam partem aceti primo extillantis tanquam nimis debilem, reliquum excipe ad siccitatem ferè totalem, cavendo tamen ne ab aceti mellagine tetrum acquirat odorem.

Dulce est gustui, datur, ad ℥ j. v. *& ultra in febribus intermit. pro Vomitorio & contra Epilepsiam phlegmaticam a Ventriculo suscitatam.*

HOFMAN. *Aqua Saturnina sive Æsculapii vomitoria*) Hæc aqua nihil aliud est, quam solutio Saturni aceti stillatitii ... beneficio peracta, prodeunte duntaxat solo aceti ... phlegmate; saccharo Saturni subsidente in Alemb ..., unde ergo vis vomitoria?

CAPVT XXXIX

De Aquis reliquis

PRæter aquas destillatas sunt ... officinal..., ex destillatis scilic. simpli... na, & ... dente rerum aliarum incocti..., ... extione, resultantes.

Modus parandi nihil di... modo decoction... ...ionisve, alias trad...

Usitatiores hujus ...

Aqua Opt... ... H ... *Op...*

FIG. 39.— PAGE FROM *Schroedero-Hoffmann Pharmacopoeia*, 1687, SHOWING THE SIGN OF JUPITER PRECEDING THE FORMULAS. NOTE THE FORMULA AT THE TOP OF THE RIGHT HAND COLUMN. SEE PAGE 81.

rack. Galileo was not built of stern enough stuff to withstand such mental agony, so he recanted before the torture actually occurred. He was then sentenced to abjure and curse the heresies which he had cherished.

Galileo lived in retirement for more than ten years, during which time he completed his classic work on mechanics and motion and inspired his pupil Torricelli to carry on investigations in physics. His books were removed from the *Index* in 1818, and by the irony of circumstances, one of the best equipped astronomical observatories in Europe at present is the one at the Vatican.

It is difficult to understand this ecclesiastical opposition to scientific progress unless we quote from a contemporary astronomer who held orthodox views, to illustrate the mental attitude and knowledge of the time. The following extract is from the works of Francisco Sizzi, a Florentine astronomer who argued against the discovery of the satellites of Mars:

> There are seven windows in the head, two nostrils, two eyes, two ears, and a mouth; so in the heavens there are two favorable stars, two unpropitious, two luminaries, and Mercury alone undecided and indifferent. From which and many other phenomena of nature, such as the seven metals, etc., which it were tedious to enumerate, we gather that the number of planets is necessarily seven.
>
> Moreover, the satellites are invisible to the naked eye,

and therefore can have no influence on the earth, and therefore would be useless, and therefore do not exist.

Besides, the Jews and other ancient nations as well as modern Europeans have adopted the division of the week into seven days, and have named them from the seven planets; now if we increase the number of planets the whole system falls to the ground.

Contemporaneous with Galileo was William Gilbert, physician to Queen Elizabeth, who is said to have been the founder of electrical science through his researches upon the magnet, which occupied eighteen years of his time.

Another contemporary of Galileo was René Descartes, the celebrated French philosopher and founder of what has been called the Cartesian school of thought. He was born in 1596 and was the son of a wealthy family, who spent much of his early life vainly occupied in his own narrow pursuits, independent of culture and with contempt for the classics and literary and esthetic studies. The lure of society was interrupted suddenly by a strange whim which led him into mathematics. He left Paris and went to Holland where he spent most of his life as a student of mathematics and the physical sciences.

He was a master of deductive research and the author of the famous saying "*cogito ergo sum.*" His mathematical works on a new system

of algebraic and analytical geometry made Newton's *Principia* possible. His theory of vortices is an interesting contribution to physics. His philosophic attitude was his most marked attribute, and he wrote an interesting article on "*The method of rightly conducting the reason and seeking truth in the sciences.*"

William Harvey was born in 1578 in Folkstone, England. He was graduated at Cambridge in 1599 and then traveled in Europe and studied under Hieronymus Fabricius, a famous lecturer on anatomy at Padua. He returned to London about 1602 and settled down to medical practice, becoming a member of the College of Physicians in 1604. In 1615 he began to teach his ideas regarding the circulation of the blood. Not until 1628, however, did he publish his tradition-shattering book on the subject. The title of this work is *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus.*

This book revolutionized the teachings and practices in anatomy and surgery. Michael Servetus and Andræus Cæsalpinus, in the previous century, had glimmerings of the truth, but their conclusions were imperfect or incomplete. Harvey was treated as a friend by the unfortunate Charles I, and he spent his latter years at Oxford. Harvey was a supporter of the Society of Apothe-

caries and had many friends among their group, with whom he often dined.

Antony Leeuwenhoek was born in 1632 in Delft, Holland. He was the proprietor of a dry goods store and the janitor of the City Hall of Delft, who, for recreation spent his time in grinding lenses and making microscopes, of which he eventually possessed several hundred. He was the first to successfully make what we now call the compound microscope, and wrote many interesting letters to scientists with whom he corresponded in different parts of Europe, telling them of the interesting things he could see with the aid of this new optical instrument. He was the first to detect microscopic forms of life, including bacteria. He was the first "microbe hunter," and in recognition of his discoveries was made a member of the Royal Society of London on the recommendation of Hooke, Newton, and other scientists.

In 1642, the year that Galileo died, Isaac Newton was born in Woolsthorpe, England. Newton received his first employment in the shop of Mr. Clark, the local apothecary, and his first acquaintance with and inspiration from books came from the library of his pharmaceutical friend and patron. He entered Trinity College, Oxford, in 1664, and in 1669 was graduated and

immediately elected to the chair of mathematics. His experiments upon optics, in which he directed scientific thought along correct lines, began in 1666 while he was a student.

The well known story of the falling apple and its connection with the idea of gravitation was first told by Voltaire after Newton's death, and he claimed to have received it from Newton's step-niece, who lived with him. His most noted public work is the *Principia,* in which his recognition of gravitation as the centralizing force of the universe is expounded and the laws of motion enunciated. These laws, discovered by Galileo, had never been concisely and clearly stated for the benefit of contemporary thinkers. He was the discoverer of the mathematical principle known as the binomial theorem and also of the differential calculus, and the inventor of the sextant and the reflecting telescope.

He was an exemplification of the classic type of an absent-minded professor, a silent, uncommunicative, lonely soul, who lived without any recreation or pastime, with his head in the clouds of his philosophical and mathematical abstractions. Newton must have had more than passing interest in and knowledge of alchemy. He and Boyle worked together upon experiments with ether, which had been first prepared by Valerius

Cordus more than one hundred years previously but was still a chemical mystery and had been known by various non-descriptive titles such as *aqua Lulliana, aqua temperata, oleum dulce Paracelsi,* and *oleum vitrioli dulci.*

One of his contemporaries and friends was the Dutch astronomer and mathematician Huyghens of Leyden, who was also a member of the Royal Society of London. Leibnitz, the German philosopher and mathematician, did his best work in the latter part of the seventeenth century.

Several old alchemistic volumes recently offered for sale not only bear Newton's bookplate but many annotations, references and corrections in his own handwriting. One of these books is by Elias Ashmole, an English alchemist, contemporaneous with Newton. Its title is *Theatrum Chemicum Britannicum.* The other is by Zacharias Brendel, an alchemist of Jena in the seventeenth century. The title of this book is very lengthy and involved, but the work principally concerns the preparation of potable gold. Newton also had a copy of one of Dee's works in his library and one of Geber's, the latter containing copious notes in Newton's handwriting.

Jan Swammerdam (1637–1680), the famous Dutch anatomist, had his first inspiration in his father's apothecary shop, which contained the

finest zoölogical collection of the country, his father's hobby being natural history.

The close of the seventeenth century saw many events which were forerunners of progress. The first daily newspaper and the first penny post were both established in England about 1690.

England and Holland had by this time wrested from Portugal and Spain the last remnants of the world traffic in drugs and spices, which these nations had taken from Venice.

The work of Paracelsus in the previous century had borne rich fruit. The influence of the philosophers and scientists of this golden century of progress is being felt even in our own time.

CHAPTER IX

THE PROGRESSIVE EIGHTEENTH CENTURY. PHARMACY ASCENDANT. THE BIRTH OF CHEMISTRY. THE BEGINNINGS OF MODERN SCIENCE

"Thrice happy were these golden days of old,
When dear as Burgundy, ptisans were sold,
When patients chose to die with better will,
Than live to pay the 'pothecaries' bill."

THE apothecaries of Great Britain and of London in particular had attained such prominence and entrenched themselves so firmly in the esteem of the public by staying at their posts during the Great Plague of London, in 1665, when most of the physicians (even including the great Sydenham) fled, that it was natural they should take advantage of their strategic position. They not only considered themselves indispensable as compounders and dispensers of drugs, charging accordingly, but they also started prescribing for minor ailments, and thus brought to a crisis the feeling of opposition toward them which the physicians had been gradually developing.

The charges of the apothecaries had become outrageously exorbitant. One pharmacist of the late seventeenth century is recorded as having

charged the equivalent of $7.50 for a single pill, and over $150 for a boxful, on a prescription. Another (who, by the way, was a physician as well) is stated to have been " so impudent and unconscionable in the rating of his medicines that he charged £6 (equivalent to $30) for one pill and the same for an apozeme." This one was prosecuted by the College of Physicians.

The physicians claimed that their regular fee for a visit was half a sovereign (about $2.50), and that an apothecary had been known to make from £150 to more than £300 (equivalent to from $750 to $1500) on a single case. Jacob Bell, an English historian of pharmacy, quotes a detailed apothecary's bill for a single day's service to a Mr. Dalby of Ludgate Hill. The itemized bill is as follows:

> An Emulsion, 4*s*. 6*d*. A Mucilage, 3*s*. 4*d*. Gely of Hartshorn, 4*s*. Plaster to dress Blister, 1*s*. An Emollient Glister, 2*s*. 6*d*. An ivory pipe, armed, 1*s*. A Cordial Bolus, 2*s*. 6*d*. The same again, 2*s*. 6*d*. A cordial draught, 2*s*. 4*d*. The same again, 2*s*. 4*d*. Another bolus, 2*s*. 6*d*. Another draught, 2*s*. 4*d*. A glass of cordial spirits, 3*s*. 6*d*. Blistering plaster to the arm, 5*s*. The same to the wrists, 5*s*. Two boluses again, 5*s*. Two draughts again, 4*s*. 8*d*. Another emulsion, 4*s*. 6*d*. Another pearl julep, 4*s*. 6*d*.

The total bill of this patient for five days' illness was £17 2*s*. 10*d*. (equivalent to nearly $100).

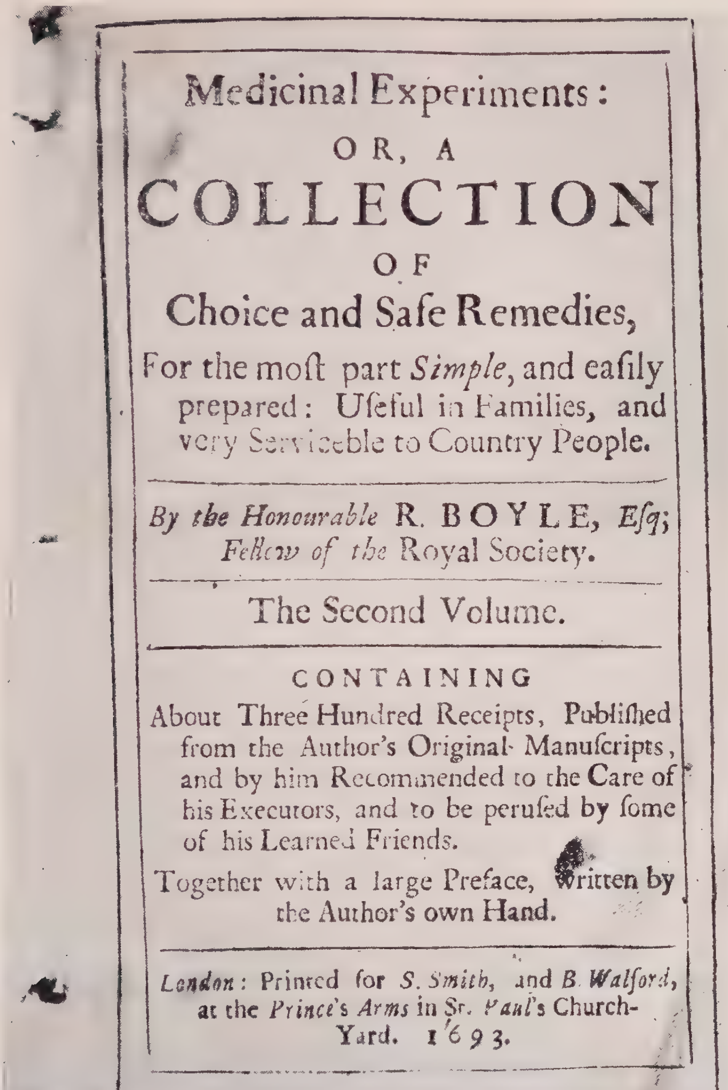
In retaliation the College of Physicians

adopted a resolution binding all Fellows, candidates, and licentiates of the College to give advice gratis to the neighboring sick poor, when desired, within the city of London or within seven miles around. They also assessed the members £10 each to establish dispensaries for supplying drugs to the poor at cost price. Much pamphleteering and scurrilous writing on the part of both factions and their friends then followed. Doctor Garth, who has been previously quoted, wrote the lines which open this chapter. Alexander Pope, the most famous poet of the time, of whom a modern critic has said that he was "the poet whom everybody quotes and nobody reads," took a hand in the fight, aligning himself with the physicians, in the following lines:

> "Modern 'pothecaries taught the art
> By doctor's bills to play the doctor's part,
> Bold in the practice of mistaken rules."

Garth was apparently on both sides of the fence, for of this move on the part of the physicians to furnish medicines at cost, he says:

> "Our manufactures now the doctors sell,
> And their intrinsic value meanly tell;
> Nay, they discover too (their spite is such)
> That health, than crowns more valued, costs
> not much;
> Whilst we must shape our conduct by these rules,
> To cheat as tradesmen or to fail as fools."



Medicinal Experiments:

OR, A

COLLECTION

OF

Choice and Safe Remedies,

For the moſt part *Simple*, and eaſily prepared: Uſeful in Families, and very Serviceble to Country People.

By the Honourable R. BOYLE, *Eſq*; *Fellow of the* Royal Society.

The Second Volume.

CONTAINING

About Three Hundred Receipts, Publiſhed from the Author's Original Manuſcripts, and by him Recommended to the Care of his Executors, and to be peruſed by ſome of his Learned Friends.

Together with a large Preface, written by the Author's own Hand.

London: Printed for *S. Smith*, and *B. Walford*, at the *Prince's Arms* in St. *Paul's* Church-Yard. 1693.

FIG. 40.—TITLE-PAGE OF THE COLLECTION OF PHARMACEUTICAL RECIPES PUBLISHED BY SIR ROBERT BOYLE, THE EMINENT ENGLISH CHEMIST. SEE PAGE 315.

The physicians went so far as to invoke an old law passed during the reign of Henry VIII, to prevent the apothecaries from prescribing. This was similar to the enforcement of what are called by us the "blue laws," for Henry, the much married, had been in his grave for nearly 200 years. An action was brought against a London apothecary named William Rose, who had attended a butcher and had prescribed for him. The apothecary's defense was that he had neither taken nor demanded any fee for his advice but had charged only for the medicines administered. The case was argued several times and was finally decided by the lower court in favor of the College. Rose had eminent counsel who appealed the case to the House of Lords, demanding a reversal of judgment. After hearing extensive arguments on both sides the judgment was reversed and apothecaries became recognized medical practitioners with certain limitations, which privilege is still retained in England, to a certain extent.

A distinction came about between apothecaries and druggists. The druggists were restricted to dealing in and preparing drugs for apothecaries, while the latter were permitted to both prescribe and dispense, as previously stated. The term "druggist" had but recently come into extended use. It is probably of Teutonic origin,

the root word "drogue" signifying a dry herb. In later times, the term "druggist," especially in the United States, signified the wholesale dealer, while the apothecary or pharmacist was the retailer. Now the terms "pharmacist" and "druggist" are practically synonymous in this country, while the word apothecary is seldom seen.

Under the reign of George I in Great Britain, in the early part of the eighteenth century, apothecaries were exempted from serving on juries, but they were required to compound their preparations according to the *London Pharmacopœia* and were subject to inspection as to the quality and strength of their drugs and medicines. This exemption from jury duty must have been rescinded later, for in Dickens' celebrated trial of Bardwell vs. Pickwick, the chemist asked to be excused from jury duty on the ground that the boy who was left in the shop had the impression that "Epsom salts means oxalic acid, and syrup of senna, laudanum."

In Germany, pharmacy seems to have been developed along more commercial lines than in Great Britain. The illustrations of pharmacies of this period show stores even more commodious than many modern pharmacies, with carved woodwork and ornamental majolica or porcelain

shelf containers, as well as large glass bottles. One of the most famous of these was the court pharmacy at Rastatt (see illustration No. 29, opposite p. 244), which was owned by J. L. Kellner at the beginning of the eighteenth century. Kellner must have been a field apothecary under his patron, the Count of Baden, in the war of that time against the Turks, for there is in the Germanic Museum a fully equipped army field pharmacy, which had been preserved in this store for more than 200 years.

Another famous pharmacy of the early eighteenth century in Germany was the Star Pharmacy at Nuremberg, where the richly colored majolica ware of that time is in use in the same pharmacy today, although the location of the store has been changed.

A pharmacy of Klattau, Bohemia (see illustration No. 49, opposite p. 436), which dates from about the same period, was originally established by the Jesuits, who decorated the store in the same style as their churches at that time.

At different periods in the history of pharmacy there have been examples of the idealization of the calling. One of the most interesting of these has been found in a church at Werder, near Potsdam, Germany, where there is a painting of

Christ represented as an apothecary (see illustration No. 52, opposite p. 462).

The painting, which is believed to date from the early eighteenth century, shows Christ represented in a conventional manner as regards features and dress. He is portrayed in the act of compounding a prescription, with the balance and the pharmaceutical containers on the counter before him. The containers bear the symbolic labels (in German) for the virtues of patience, hope, love, steadfastness, help, peace, grace, and faith, the latter being in the smallest container, evidently indicating its precious character.

Several scriptural passages are quoted upon the standard which is shown in the background.

In an interesting eighteenth century book upon pharmacy by John Conrad Barchusen, published in Lyons in 1712 (see illustration No. 43, opposite p. 382), there is an illustration of a pharmacy which differs from all of those previously described (see illustration No. 44, opposite p. 392). In it much apparatus is in evidence in the foreground and on the shelves, while a large folio volume is lying open on the counter beside the ever present contusion mortar. Five figures are shown, one of which looks like a woman, and she is expounding or explaining something from the open volume. The distinctive feature of this illus-

tration is the fact that the entire set of shelving in the rear of the store is filled with books of various sizes.

The eighteenth century pharmacist must have been more devoted to his books than the modern practitioner, for few pharmacies at present can boast of even a "five foot shelf" of pharmaceutical works. The author of this book, Barchusen, was a professor of pharmacy, medicine, and chemistry at the University of Utrecht until 1732.

Neither England or Germany, furnished as many famous pharmacists as did France, during the eighteenth century. There was one famous Dutchman, Hermann Boerhaave of Leyden, who, while not a pharmacist, had a great influence upon pharmacy and upon chemistry through his books, the most important of which was his *Elementa Chemiæ*. This is more valuable for the history of pharmacy and chemistry it contains, than for his own contributions, for he was one of the last of those who opposed the Paracelsan ideas of the true service of chemistry being the preparation of medicines. He was probably the most highly educated man of his period in Europe and acquired much wealth by his practice as a physician. He is a connecting link between the old chemistry and the new, and while he was an agnostic in his views about alchemy, he wasted much time in a

laborious but fruitless investigation on mercury, to which he applied distillation many hundred of times without sensibly altering its properties.

The field of pharmacy in continental Europe had been invaded by grocers, spice dealers, distillers, etc. In France the apothecaries were not permanently freed from their association with the grocers until 1777, when the separation was effected by an edict of Louis XVI.

The archives of the Nuremberg College of Pharmacy are filled with the same kind of memorials respecting the grievances of the apothecaries that were commented upon in the history of the preceding century. In some cases the pharmacists had only themselves to blame for certain restrictions which were placed upon them, as is evidenced by the following official notice in a daily paper of Anspach:

> Since the practice among apothecaries of giving New Year's gifts to physicians and patients has been extensively abused, it should forthwith be discontinued. Apothecaries are therefore forbidden, under severe penalty, to continue this destructive and demoralizing practice. The order is herewith made known to the general public.
>
> The Secretary of State and War.

An interesting sidelight upon pharmacy is concerned with the furore in France in the early part of the eighteenth century over the sale of

poppy seeds, which had long been used as food and had been expressed for the oil that was used both for food and as an illuminant. A rumor became prevalent that poppy seeds contained the same narcotic principles as opium. Opposition to poppy seed and poppy seed oil became so violent that the Paris authorities ordered the Medical Faculty to report upon the subject. Their report was that no narcotics were present in either seeds or oil which is a correct statement of fact. This report was not accepted by the people and popular clamor forced the issuance of a decree prohibiting the sale of poppy seed oil in 1718. The sale was clandestinely carried on in spite of this prohibition and in 1735 a more severe decree was issued, which provided for the denaturing of all poppy seed oil with turpentine. The clandestine demand increased until in 1773 the Secretary of Agriculture re-investigated the problem and reversed all previous prohibitions. Thus the citizens of France were deprived of the legitimate sale of a perfectly wholesome food product for more than fifty years through the combined effect of prejudice and political power.

The renowned Friedrich Hoffmann was one of the few prominent characters influencing German pharmacy in the eighteenth century. Hoffmann was a physician who occupied a professorship at

Halle for forty-nine years and who contributed much to the literature of pharmacy. Like Boerhaave he was an opponent of the Paracelsan doctrines. He experimented largely upon the volatile oils and originated several famous preparations which have come down to our own time. One of these is elixir of orange, which he prescribed as a stomachic and carminative under the title *elixir viscerale*. The other is Hoffmann's Anodyne, which he first called *liquor anodyni mineralis Hoffmannii*. The latter he used as a secret preparation for a long time, as was then the custom even among the most eminent medical practitioners.

Hoffmann had a poor opinion of apothecaries, of whom he said: "The apothecary should know that an acid and an alkali, when brought into contact, will effervesce. It will suffice if he know the effect, although he may be ignorant of the cause."

Another German character of note was Trommsdorff. He was a true pharmacist and was the cause of much improvement in pharmacy in Germany through his establishment of a pharmaceutical journal and his founding of the Chemico-Pharmacal Institute, which still bears his name. Trommsdorff was a learned apothecary of Erfurt. Speaking of his apprenticeship and

the years he spent under different employers trying to become a master of his profession, he says:

> Rarely did I find men who aproached my ideal. More frequently, on the other hand, I met with incompetency and slovenliness. Seldom if ever did I find a proper appreciation of the pharmacist's important calling by the general public. Pharmacy was almost universally looked upon as a trade, and the pharmacist as a mere tradesman. This fact pained me the more, the firmer I became convinced that pharmacy is a worthy branch of the natural sciences, and its devotees deserve the honors so freely bestowed upon workers in other departments of the sciences. But how few of the druggists themselves were permeated by the importance of their calling.

A. S. Marggraf (1709–1782) was the son of a Berlin apothecary, who became the most noted analyst in the eighteenth century. He identified magnesia, the alums, potassa, and soda, and improved the method of manufacturing phosphorus. He was the discoverer of beet sugar.

Marggraf had an illustrious pupil in Martin Heinrich Klaproth (1743–1821). Klaproth taught chemistry for a time at the artillery school, and later at the University of Berlin. He discovered uranium, zirconium, and cerium oxide, and effected the separation of strontium and barium, which had hitherto been confused. He was one of the compilers of the editions of the

Pharmacopœia Borussica which appeared later in the eighteenth century.

J. C. Weigleb (1732–1800) was an apothecary of Langensalz, who, as a chemist aided the phlogistonists and waged war upon the alchemists. He wrote several books dealing specifically with chemical subjects.

France produced some noted pharmacists during the eighteenth century. Stephen Francis (Etienne François) Geoffroy (1672–1731) was the son of the Paris apothecary in whose store, as previously mentioned, were held the meetings of the group that resulted in the formation of the Paris Academy of Sciences, an organization by this time corresponding in dignity and importance to the Royal Society of London. He studied pharmacy at Montpellier and returned to Paris where he subsequently was graduated in medicine. He later held the professorships of pharmacy and medicine in the College of France. His chief researches were on iron, vitriol, fermentation, and mineral waters and he was the author of a noted work on materia medica. He was honored by being made a Fellow of the Royal Society of London.

Geoffroy's most famous accomplishments were the publication of an essay on *The Superstitions Concerning the Philosopher's Stone,* which had

FIG. 41.—TITLE-PAGE OF OFFICIAL PHARMACEUTICAL FORMULARY OF FLORENCE, 1696 SEE PAGE 274.

much to do with the consummation of the aim of Paracelsus to divert alchemy to more profitable channels. His most famous work was done in connection with a set of tables of chemical affinities, which had a great influence upon later developments in chemistry. Pharmacists may well feel proud of this illustrious member of their craft, for from first to last he was a retail pharmacist, although few of the historians of chemistry even mention the fact of his connection with pharmacy, but class him as a chemist pure and simple. Geoffroy's research work on vitriols cleared up a complicated subject that had bothered chemical workers from the time of Geber.

Stephen Francis Geoffroy is usually referred to as Geoffroy the Elder, to distinguish him from his younger brother Claude Joseph Geoffroy (see illustration No. 42, opposite p. 372), who was known as Geoffroy the Younger. The father of these two Geoffroys certainly spared no pains to thoroughly educate his two sons, and was amply repaid for his expenditure, for Claude Joseph Geoffroy became famous for his articles on plant chemistry, and was an authority on essential oils in particular.

Antoine Baumé (1728–1804) (see illustration No. 50, opposite p. 444), the inventor of the hydrometer which bears his name, was an appren-

tice in the pharmacy of Geoffroy. He was such a brilliant student that at the age of twenty-five he was made professor of chemistry in the same college where his preceptor was teaching pharmacy. He founded a factory for the making of sal ammoniac and devised a process for bleaching silk. Baumé's best work for pharmacy was done in connection with dispelling the traditional superstitions of pharmacy with regard to the polypharmacal combinations of disgusting ingredients.

He was the author of a classic treatise on pharmacy called *Elements de Pharmacie Theoretique et Pratique* (see illustration No. 54, opposite p. 482), which went through many French and English editions. He was an authority on perfumes, liquors, and the manufacture of ether. In collaboration with Macquer he helped to revise the nomenclature of chemical compounds.

Baumé and Macquer gave courses of lectures upon chemistry for twenty-five years. During that time they are said to have given sixteen complete courses, each of which was illustrated with more than two thousand experiments. These lectures were attended by hundreds of students, some of whom later became famous in chemistry. Baumé is another of the eighteenth century apothecaries whose connection with pharmacy is usually overlooked by chemical historians.

Pierre Joseph Macquer (1718–1784), referred to in connection with Baumé, was of a noble Scotch family of Roman Catholics who had settled in France on account of their religion. He was a master of pharmacy, doctor of medicine, and professor of chemistry of the *Jardin des Plantes*. He was also Director of the royal porcelain factory at Sèvres, but is best known for his *Dictionary of Chemistry* which at first appeared in three volumes and in later editions was increased to six. He was an authority upon many scientific subjects and was one of the few scientists who sided neither with Stahl nor with Lavoisier in the matter of the phlogiston theory, but tried to evolve an entirely different explanation of combustion.

Pierre Bayen (1725–1798) is noted for having organized French military pharmacy, spending most of his life in that service. He was an authority on mineral waters and had proved the harmlessness of pure tin as a coating for utensils used for food.

Antoine Augustin Parmentier (1737–1813) was another prominent member of the French Army Pharmaceutical Service. He was taken prisoner a number of times in the war with Germany, and upon one of these occasions subsisted entirely upon potatoes for a long period. Pota-

toes at the that time were unknown in France. Upon his return to his native land he became chief pharmacist of the *Hotel des Invalides,* and as a hobby worked for many years to introduce potatoes into France and to overcome the prejudices against them. He cultivated potatoes successfully upon an apparently hopeless piece of land which the government had allowed him to use for experimental purposes, and when his plants flourished and blossomed he made a bouquet of the flowers and presented it to Louix XVI, who wore some of them as a boutonniere. His triumph was complete and potatoes were soon under general cultivation in France and became one of the staple food products.

Guillaume François Rouelle (1672–1731) was an apprentice in the Paris pharmacy which had once been Lemery's, and subsequently opened his own establishment. He gave courses of private lectures which were very popular because of his earnestness and thoroughness. Lavoisier is said to have been a student of one of these courses. He declined the honor of being made apothecary to the King, in order that he might have more time for his researches. His most notable work was the classification of chemical salts into acid, neutral, and basic. He tried to make concentrated preparations of a number of

alkaloidal drugs and came very near to being the first discoverer of alkaloids.

Gilles François Bolduc (1675–1742) (see illustration No. 42, opposite p. 372), was for many years first apothecary to Louis XIV and an authority of his times upon pharmaceutical matters. His essays on Epsom, Glauber's, and Seignette's salts helped to popularize the use of these saline laxatives.

Claude Louis Berthollet (1748–1822) was an eminent chemist and physician who followed Macquer as Director of the Sèvres porcelain works. He was accomplished in technical chemistry. He first made potassium chlorate which was called *Sal de Berthollet.* He was one of the earliest to point out the fallacy of Lavoisier's generalization to the effect that oxygen was a necessary constituent of acids, using hydrosulphuric acid and hydrocyanic acid as his examples.

Antoine Laurent Lavoisier was not a pharmacist, but his services to chemistry were so remarkable that pharmacy was benefited, as were all other sciences. The importance of his work cannot be appreciated without some discussion of the phlogiston theory of combustion, to which reference has been made several time incidentally. J. J. Becher, the German chemist, was discussed in connection with the history of the

seventeenth century. His pupil and ardent disciple, Georg Ernest Stahl (1659–1734) carried forward the teachings of his preceptor, which in essence were as follows:

These experimenters believed and taught that combustion is a decomposition or dissolution of compound bodies; that simple bodies cannot undergo combustion. The cause of combustibility resided in a fatty earth called *terra pinguis,* which was present in all combustible substances. Two other principles were present called respectively *terra mercurialis,* which was volatile, and *terra lapidia,* which was a vitrifiable principle. When the *terra pinguis* was expelled from a metal by heating, the *terra lapidia* remained, and this was the " calx " of the metal, as the oxide was then mistakenly called. Stahl changed the name of this *terra pinguis* to " phlogiston." Stahl said:

> It is to be kept in mind that as well as the fat with which one smears his shoes, as in the sulphur of the mines, and all metals, partly or wholly combustible, there is actually this same essence (phlogiston), which gives and constitutes its inflammability.

This led to such misleading terms as " phlogisticated air," which was applied to nitrogen, and " dephlogisticated air," which was applied to oxygen. Stahl's phlogiston theory formed the basis of chemical research for more than fifty years

during the eighteenth century, and its adherents and antagonists carried the battle well into the nineteenth century, although the phlogistonists had been utterly routed by the convincing and analytical demonstrations of Lavoisier. The investigators who favored the phlogiston theory had worked entirely upon the supposition that phlogiston was a material substance.

Then Lavoisier showed, by the use of the balance in connection with experimental work, that the "calx" of a metal weighed more than the original metal, and when he subsequently confirmed Priestley's observations that the calx of mercury gave off this dephlogisticated air and lost correspondingly in weight, and that the acids with which he was familiar contained this same principle, he changed his first name for this gas "vital air" to "oxygen," from the Greek root *oxos,* acid, because it was an acid former.

Lavoisier was born in 1743 and he met an untimely end under the blade of the guillotine in 1794. Had he lived there is no telling what progress he might have made in the early part of the nineteenth century, when much valuable time was lost in accepting his views because he was not there to defend them. LaGrange said at the time of Lavoisier's execution, "It took but a moment to cut off that head, though a hundred years per-

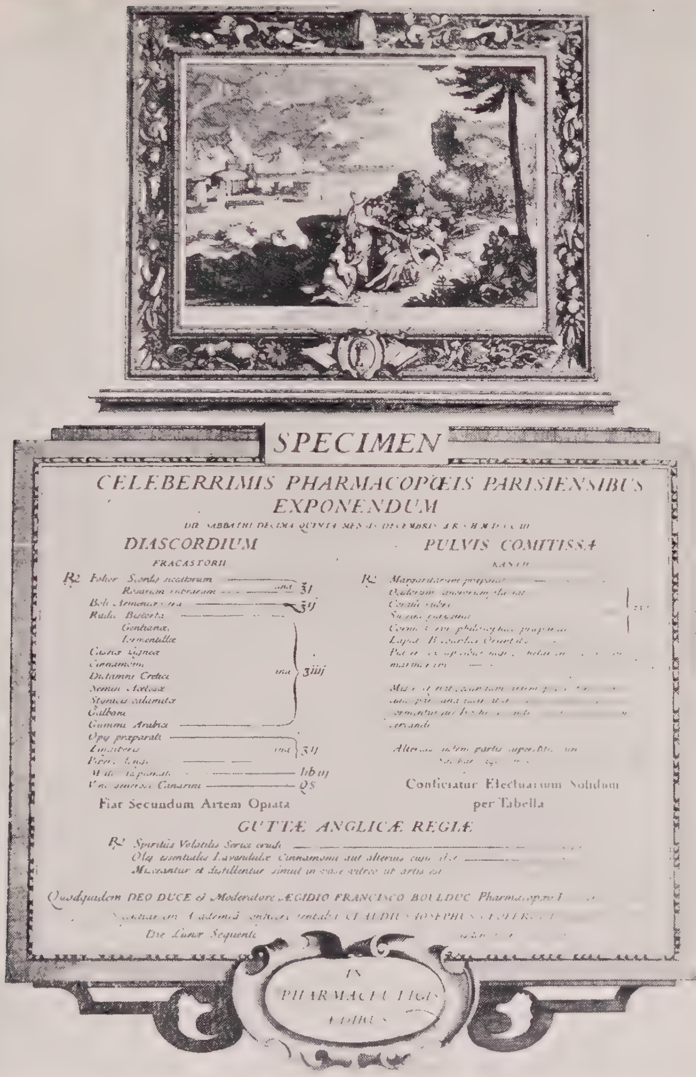
haps, will be required to produce another like it."

Lavoisier's discoveries led to a complete revision of the nomenclature of chemistry, much of which remains today as he devised it.

One of his co-workers and interpreters was Comte Antoine François de Fourcroy, who wrote a number of chemical text books and expositions of the new nomenclature proposed by Lavoisier, and in which connection Fourcroy had been a collaborator. A commission on the new nomenclature of chemistry consisted of Lavoisier, Fourcroy, Berthollet, and Morveau.

Several other eminent chemists played an important part in the real development of the science. Joseph Black (1728–1799) was a Scotch chemist who was connected with the Universities of Glasgow and Edinburgh, respectively. His principal work was upon magnesia and quicklime. He rediscovered the "gas sylvestre" of van Helmont and called it "fixed air."

Henry Cavendish (1731–1810) was an English chemist, educated at Cambridge, and as he was very wealthy and fond of science, he turned his residence into laboratories and workshops. His name is inseparably associated with hydrogen, which he isolated and whose properties he studied, and with the discovery of the composition of water. He called hydrogen "inflammable air."



SPECIMEN

CELEBERRIMIS PHARMACOPŒIS PARISIENSIBUS EXPONENDUM

DIASCORDIUM

FRACASTORII

PULVIS COMITISSÆ

Fiat Secundum Artem Opiata

Conficiatur Electuarium Solidum per Tabella

GUTTÆ ANGLICÆ REGIÆ

Misceantur et distillentur simul in vase vitreo ut artis est

Die Lunæ Sequente

IN PHARMACEUTICIS

FIG. 42.—SPECIMEN PAGE FROM A COMMENTARY ON THE *Paris Pharmacopoeia*, COMPILED BY TWO FAMOUS FRENCH PHARMACISTS, GEOFFROY THE YOUNGER AND BOULDUC. SEE PAGE 369.

He was the first experimenter to observe that a small proportion, less than 1 per cent., of the nitrogen of the air behaved in a different manner from the rest. More than a century after Cavendish's time Lord Rayleigh and Sir William Ramsay isolated argon, helium, and other inactive gases from this small residual portion which had resisted all efforts to decompose it. Cavendish also established the constitution of the atmosphere, his figures being almost identical with those obtained by the most careful experimenters of modern times. By some authorities Cavendish is credited with the discovery of nitrogen. Rutherford is said to have also discovered this element in 1771, and to have invented the maximum and minimum registering thermometer.

Joseph Priestley (1733–1804), a non-conformist minister who turned to science for recreation, was one of the most highly educated men of England in the late eighteenth century. He had taught Latin, Greek, Hebrew, French, and Italian, and gave lectures on logic, elocution, oratory, criticism, history, civil law, and anatomy. He had formed a friendship with Benjamin Franklin, and it was through this friendship that he turned his attention to philosophy and science.

In 1767 he took charge of a Unitarian congregation in Leeds, and while there began experi-

ments with different kinds of air, utilizing the waste carbon dioxide of a nearby brewery for part of his experimental material. In 1772 he became secretary to Lord Shelburne, with whom he remained for seven years, continuing his experiments during his leisure time. Later he went to Birmingham as minister to a Liberal congregation and formed friendships with Isaac Watt, Josiah Wedgwood, and Erasmus Darwin. In 1791 riots occurred in Birmingham and Priestley's house and laboratory were destroyed by religious fanatics whose battle cry was "Church and King." Priestley was forced to flee from Birmingham in disguise. He later wrote a letter to a Birmingham newspaper in which he said:

> You have destroyed the most truly valuable and useful apparatus of philosophical instruments that perhaps any individual in this or any other country was ever possessed of, in my use of which I annually spent large sums with no pecuniary view whatever, but only for the advancement of science——. But what I feel more, you have destroyed manuscripts which have been the result of laborious study of many years and which I shall never be able to recompose.

What a terrible blow! It reminds one of the loss of the manuscript of Carlyle's French Revolution, which was accidentally burned by a servant for waste paper, but Carlyle could and did rewrite his work, for he had only to reconsult his

authorities. In scientific work it is different; what is destroyed can rarely be replaced.

The state of development of the chemistry of Priestley's time may be appreciated from the following paragraph taken from the preface of one of his books, describing a course of lectures at Hackney College, England:

> I contrived to bring within that compass as much of the subject of experimental philosophy as well I could and especially to include the whole of what is called chemistry to which so much attention is now given, and which presents so many new fields of philosophical investigations.

Priestley's claim to fame rests upon his essays entitled *Experiments and Observations on Different Kinds of Air,* and *Dephlogisticated Air,* which were published in 1775 and 1776. In *Dephlogisticated Air* Priestley had isolated what later came to be called oxygen. He studied its properties so thoroughly that in his original essay he was able to predict many of the uses for which this gas has served in later years, such as a supporter of ebbing vitality and in the oxyhydrogen blowpipe.

In 1793 Priestley came to America and ended his days peacefully in 1804 at Northumberland, Pa. He was the last great defender of the phlogiston theory, and after having established himself in Northumberland, in America, he wrote

his last book, which was published in 1800, entitled *The Doctrine of Phlogiston Established,* a pathetic example of misguided energy, for even while he wrote, the phlogiston theory was on its last legs.

The pharmaceutical and chemical superman of the eighteenth century was neither a Frenchman, a German, or an Englishman. He was a Swedish apothecary named Carl Wilhelm Scheele. He was born in 1742 in Stralsund, Pomerania, and died at his apothecary shop in Köping, Sweden, in 1786. His father was a merchant and Carl was the seventh in a family of eleven children. He was not particularly brilliant as a youth but had an aptitude and a liking for pharmacy. At the age of fourteen he was apprenticed to an apothecary named Bauch in Gothenberg, two hundred miles from his home town, and he remained in this position for eight years. During this time he is said to have studied the works of John Kunkel.

In 1765 he went to Malmö, where he entered the service of a pharmacist named Karlstrom; from thence he went to Stockholm to work for Scharenburg, a prominent apothecary of that city. Here his first important work was done—the study of cream of tartar and the discovery of tartaric acid, and the isolation of phosphoric acid

from bones. In 1771 he discovered hydrofluoric acid, which he obtained from fluorspar.

In Upsala was a teacher of chemistry named Torald Bergmann, who had been the first to write chemical reactions in a crude manner. Bergmann became interested in Scheele's work and induced him to come to Upsala where he became Scheele's adviser and patron. Here during the years 1774 and 1775 Scheele discovered and identified potassium permanganate, manganese dioxide, barium oxide, chlorine (which he called "dephlogisticated hydrochloric acid"), arsenic acid, hydrogen sulphide, the arsenical pigment known as Scheele's green, molybdic acid, benzoic acid, and last but not least, oxygen, which he called "empyreal air." Scheele's discovery of oxygen was entirely independent of that of Priestley, and of Lavoisier, who had also obtained it in the pure state.

Scheele then left Upsala for Köping where he secured the rights to an existing pharmacy, which he found in bad financial shape. He temporarily turned away from his experimenting, put the store on a good paying basis and then resumed his scientific studies. Here he made lactic acid, separated and identified glycerin as a by-product in the manufacture of lead plaster, and discovered citric, malic, gallic, oxalic, uric, and mucic acids,

ethyl acetate, ethyl benzoate, amyl alcohol, and hydrocyanic acid.

Scheele's work for the most part was made public through communications to the Academy of Science of Stockholm. After his death his collected works were published under the title *Opuscula Chemica et Physica,* first in Latin, from which they were quickly translated into all modern languages, for Latin was ceasing to be the exclusive language of science.

Tradition has it that Scheele's death was caused by the accidental inhalation of hydrocyanic acid while experimenting with it in his laboratory. Like Lavoisier, he died in the prime of life and science was thereby deprived of many important discoveries, for they were coming from his laboratory in rapid succession at the time of his death.

In a copy of Scheele's works, translated into English and bearing the publication date of 1786, the translator, Thomas Beddoes, quotes a saying of the time that "the greatest of Bergmann's discoveries was the discovery of Scheele." Somebody must have plagiarized and paraphrased that remark about fifty years later, for the same quotation in almost exactly the same words is frequently applied to Humphrey Davy and his discovery of Michael Faraday.

Contemporaneous with Scheele and his co-

workers, and indirectly connected with chemistry was Count di Cagliostro. Cagliostro is the *nom de guerre* of an individual believed to be identical with Giuseppe (Joseph) Balsamo, a Sicilian swindler of the latter part of the eighteenth century. "Count" Cagliostro, as he called himself, appears prominently for the first time in 1776 in London in connection with a Masonic organization called the "Order of Strict Observance." He next devised a new secret society which he called Egyptian Masonry, which was to reform the entire world. He claimed to have the power of transmuting metals, of a miraculous healer, and to be the possessor of the Elixir of Life. He figured in many court intrigues and scandals in various European capitals, the most notable of these being what historians call "The Diamond Necklace Affair," in connection with which he suffered imprisonment for a time in the Bastile. Surrounding himself with an air of mystery and affectation, he was credited by many with having in his possession the secret of continuing his existence through many ages, and to have had a history and experience comparable to that of the Wandering Jew.

Apparently possessed of great wealth of mysterious origin, he passed through the period from 1776 to 1789 like a meteor, and finally

passed out after conviction by the Inquisition and imprisonment for life. When the battalions of the French Revolution entered Rome and attempted to release the entombed adept by force, they were informed that Cagliostro was dead. The familiar spirits, who had summoned the shades of the departed at his behest at many notable seances in Paris in the days of his glory, seem to have deserted him, and the illustrious proprietor of the "Grand Magisterium," as the philosopher's stone was sometimes called, died in loneliness and want.

In general science in the eighteenth century, the list of workers is so long that we can take time to merely run over the names and fields of work of the leaders. Carl von Linné, whose name is better known in the Latinized form of Linnæus, was the individual who placed the science of botany upon its firm foundation by discarding the cumbersome and indefinite system of naming plants which had previously existed and adopting the binomial system of nomenclature which is in use today in all fields of natural science. He also proposed a system of plant classification which was soon superseded by that of Bernard de Jussieu and Antoine de Jussieu, two contemporary French botanists, whose natural system of

plant relationships has stood the test of time and is still in use, with some slight changes.

Linnæus was probably the greatest botanist who ever lived, and his opportunities for leaving his impress for all time upon his beloved science were unequalled, for travelers and scientists from both hemispheres placed in his hands specimens for classification and naming. The names used by Linnæus for specific names were distinctive and full of meaning. The many plants from the new world with specific names like *Canadensis, Virginica, Marilandica, Pennsylvanica,* etc., are Linnean names and indicate the colony in America from which he received the initial or type specimen. He is said to have named about 10,000 species. "Officinalis" is a frequently used Linnæan specific name indicating that this particular species was the one used in medicine and sold in the "*officina*" or shop.

Bernard de Jussieu was a native of Lyons, France, who, after graduating in medicine became demonstrator at the Royal Plant Gardens (*Jardin des Plantes*) in Paris. He did not favor the artificial plant classification of Linnæus but evolved one which was more systematic. This was elaborated after his death by his nephew, Antoine Lamont, who gave it to the world under the title *Genera Plantarum.* This system was sub-

sequently expanded and improved in the nineteenth century by De Candolle and others and is the basis of the classification now used by botanists everywhere.

The pioneer scientific work for zoölogy during the eighteenth century was accomplished by Comte Georges Louis le Clerk de Buffon (1707–1788), Jean Baptiste de Lamarck (1744–1829), and Georges Baron de Cuvier (1769–1832). Buffon was more of a philosopher and general scientist, Cuvier founded the science of comparative anatomy, and Lamarck made possible Darwin's epoch-making work in the following century.

In geology notable studies were made by Werner of Saxony, Demarest the Frenchman, and Hutton the illustrious Scotchman. James Hutton (1726–1797) was a philosopher and a chemist. He was so successful in the latter field that he made a fortune by extracting sal ammoniac from chimney soot. This artificial sal ammoniac was called *sal ammoniacum factitium* in later dispensatories. He afterward studied medicine, became an agriculturist, and finally retired to devote his life to meteorology and geology. In the latter field he paved the way for Lyell and other eminent geologists of the succeeding century.

JOHANNIS CONRADI
BARCHUSEN

SYNOPSIS PHARMACIÆ,

Methodum pleraque medicamenta, ſive a Veteribus ſive ab Recentioribus excogitata, componendi juxta & conficiendi tradens.

EDITIO TERTIA

Accedunt duo indices, quorum alter remediorum *doſin* : alter Medicamina cuivis corporis affectui ſingulariter dicata, monſtrat

LABORE ET COELI FAVORE.

LUGDUNI BATAVORUM,

Apud THEODORUM HAAK. Bibliopol.
clɔ Iɔcc xii.

FIG. 43.—TITLE-PAGE OF BARCHUSEN'S *Synopsis of Pharmacy*, AN EARLY EIGHTEENTH CENTURY BOOK DEALING EXCLUSIVELY WITH PHARMACEUTICAL DEFINITIONS. SEE PAGE 358.

Sir James Hall, another Scotchman and a reluctant convert to Hutton's theories, carried geology into the laboratory and became the founder of the experimental school of geology. A third great figure in the geological field at that time was William Smith, an Englishman, whose specialty was recording geological data in the form of maps such as are used for that purpose today.

Cosmogony in general and astronomy in particular made great strides during the eighteenth century. The German philosopher, Immanuel Kant (1724–1804) was primarily a scientist whose *General Natural History and Theory of the Heavens,* written at the age of thirty-one, was a creditable work. His views were probably stimulated by the views of Thomas Wright (1711–1786), who in 1750 had published *An Original Theory and New Hypothesis of the Universe.* J. H. Lambert (1728–1777) supplemented the work of these two and paved the way for Laplace, who followed in the next century.

Celsius (1701–1744) was a Swedish astronomer, who early in the eighteenth century had assisted a French expedition in the important work of measuring a degree of the meridian. His name is particularly associated with the centigrade thermometric scale, which was first pro-

posed by him. He is frequently confused with the medical authority of the first century whose name was Celsus.

The greatest figure in astronomy during this period was Sir William Herschel (1738–1822), of German birth and English education and fame. With a telescope of his own construction he discovered the planet Uranus in 1781 and also definitely determined that the stars are suns and not merely points of light, as had been held by many up to that time. Sir William was aided by his sister, Caroline Herschel, whose indefatigable assistance, and accurate observations and calculations made much of his work possible.

Alessandro Volta (1745–1827), the noted Italian physicist, revolutionized the conceptions of electricity during this century. He was the inventor of the "voltaic pile," an electroscope and an electrical condenser. His contemporary and compatriot, Luigi Galvani (1737–1798), was primarily a physician who specialized in anatomy and whose discovery of the galvanic current was purely accidental and constituted his sole contribution to physics.

Another eminent Italian of the eighteenth century was Lazaro Spallanzani. He was an investigator of singular ability and unusual persistence. He discovered the digestive power of

the saliva and showed that gastric juice would act outside the body. His main achievement was the refutation of the doctrine of the spontaneous generation of life. He paved the way for Pasteur in the nineteenth century.

Josiah Wedgewood (1730–1795), the English potter, was a friend and patron of the scientists of his day and invented the clay pyrometer for measuring high temperatures. His daughter was the mother of Charles Darwin.

During the eighteenth century the greatest mechanical revolution the world has ever experienced commenced when the exhaustion of the wood supply of England made necessary the use of coal in smelting iron. This in turn led to the development of the steam engine from a simple pumping device to one of broad application. The æolipile of Hero (130 B.C.) had not been put to any practical use during the seventeen centuries following its invention. In the fifteenth century Leonardo da Vinci had invented a machine which propelled a ball by means of steam. In 1629 an Italian, Giovanni Branca, had designed an engine in which a wheel with paddles was turned by the impact of a jet of steam. Edward Somerset in 1663 had developed a simple pumping engine for the purpose of raising water. This engine of Somerset's was improved by Thomas Savery in

1698 but in 1690 Denis Papin had already invented a simple cylinder and piston steam engine with a safety valve. In 1705 Thomas Newcomen produced what he called an atmospheric engine and this engine was soon put to practical use in pumping the water out of the coal mines.

In 1763 James Watt, a Scottish instrument maker and mechanic, while repairing a Newcomen engine, was struck by the waste of steam and in consequence of experiments made with a view of obviating this defect, in 1769 Watt patented the first improvement and in 1781 another one which enabled the engine to give continuous revolving motion to a flywheel instead of the limited reciprocal motion of the earlier types.

It is unnecessary to discuss the profund changes produced in industry and, through that channel, in civilization itself, which have come about through the replacement of human and animal brute force by automatic mechanical devices. The time was ripe for the nineteenth century to usher in a period of development more rapid than had occurred in the whole previous history of the world, so far as material progress was concerned.

Among miscellaneous items of scientific and general progress in the eighteenth century not previously covered were the introduction of in-

oculation against smallpox by Lady Mary Montagu and the subsequent work of Jenner upon vaccination in the latter part of the same century; the publication of the first edition of the *Encyclopedia Britannica* in 1771; the publication of Adam Smith's *Wealth of Nations* and Gibbon's *History of Rome* in 1776; the experiments of Montgolfier with air balloons in 1783, and the invention of the cotton gin by Whitney in 1793. In 1751 the first medical society in the United States was founded in Boston, Massachusetts.

In 1765 the first medical school was established in the United States in Philadelphia, later becoming a part of the University of Pennsylvania; in the same year the Philadelphia Medical Society was instituted. This was followed by similar societies in New York and New Jersey in 1766. In 1784 the first daily newspaper in the United States was established in Philadelphia; it was called *The Philadelphia Packet or Daily Advertiser*. The first chemical society in America was founded in Philadelphia in 1792.

The eighteenth century saw the contributions of Handel, Bach, Mozart, Haydn, Gluck, and Beethoven, the muscians; of Addison, Steele, Pope, DeFoe, Goldsmith, Sheridan, Burns, Goethe, Rousseau, Sterne, and Voltaire, the authors; of Hogarth and Reynolds, the painters;

of Blackstone, the great lawyer. Goethe's Faust shows the influence of the author's alchemistic mysticism, for he was familiar with much of the lore of this occult art.

The establishment of American independence in 1776, and the French Revolution in 1793 were the great political upheavals of that century. The American Revolution did not have any immediate effect upon the progress of science in general and pharmacy in particular. The French Revolution, however, did create some very difficult situations inasmuch as one of the first acts of the new government in 1791 was to abolish all restrictions on every profession or trade. So many accidents and fatalities followed the rush of the untrained into pharmacy that the Assembly passed an ordinance in the same year reviving the old laws regulating the teaching and practice of pharmacy until such time as a new code should be prepared and adopted. The new code did not appear until 1803 and is the one still in effect.

One of the little known tragedies of the French Revolution, which has to do with chemistry, was the fate of LeBlanc, the originator of the process for making sodium carbonate from sodium sulphate.

Nicholas LeBlanc was born at Issoudun, France, in 1742, and although he was educated as

a physician and became surgeon to the Duke of Orleans, he paid more attention to chemistry than to his own profession. Working along lines originally suggested by De La Metherie, a contemporary, he solved the problem and had the soundness of his method passed upon by Jean Darcet, a professor of chemistry at the College of France.

The Duke of Orleans in 1791 agreed to back him financially in establishing a plant for the manufacture of this important compound on the large scale. LeBlanc was granted a patent for fifteen years and a factory was built at St. Denis. The French Revolution, which followed almost immediately, led to the confiscation of the property of the Duke of Orleans, who was one of the hated aristocrats. LeBlanc was then compelled to give his process to the public. The factory was dismantled and destroyed. In 1800, by way of compensation for his losses, LeBlanc was again given his rights in the process but he was unable to interest capital in the project, and in his desperation and disappointment he committed suicide in 1806. Within a few years after his death the process was in successful operation under other management.

The intellectual giant of the eighteenth century, however, taking all fields of human endeavor into account, was a prodigy from the new world,

Benjamin Franklin. Without either wealth or influence, by sheer force of native ability, Franklin became one of the broadest and most versatile characters the world has ever seen. Apart from his political influence, which was of great moment to the establishment of American independence, his contributions to scientific progress were many and varied. His name is connected with economics, ethics, and education, with electricity, meteorology and geology. It was he who first suggested bifocal lenses, the use of oil in calming troubled water in storms, and the building of ships with separate water-tight compartments.

He invented a stove, a musical instrument, and a clock, none of which he patented. His writings covered almost the entire range of human knowledge and many of his opinions were considerably in advance of his period. Franklin established the first hospital in the new world—the Pennsylvania Hospital in Philadelphia, and founded the first free library also, which is now the Library Company of Philadelphia. The American Philosophical Society was the outcome of a youthful group led by Franklin, which called itself the "Junto."

Franklin had several interesting contacts with pharmacy. He is said to have sold drugs himself for a few years; it is known that as a printer he

published a number of articles upon medical and other scientific subjects, and, as will be seen presently when we come to discuss American pharmacy in particular, he had a profound influence upon the development of both pharmacy and medicine by the aid and encouragement he gave to a young man named John Morgan, who later became prominent in both medicine and pharmacy.

Sir Hans Sloane, an eminent physician and scientist of Great Britain stood in the same relation to that country that Benjamin Franklin did to the new world. Sloane's early education was along pharmaceutical lines, as he obtained his first training in science at Apothecaries' Hall and at the Chelsea Physic Garden, which owes its existence today to his efforts in its behalf when it was in danger of abandonment.

Hans Sloane was born in Ireland of Scotch parentage, his father being Receiver-General of Taxes in County Down. At sixteen he was forced to give up his schooling by hemorrhages from the lungs, due to tuberculosis, which was the prevalent disease in that century in Ireland. Under skilful treatment he regained his health and strength and went to England, where he studied at Apothecaries' Hall, forming friendships with such men as Robert Boyle and Doctor Sydenham.

After four years' study in London Sloane went to Paris, Montpellier, and Orange-Nassau, at which latter place he took a medical degree *cum laude*. He returned to London, when the Royal Society elected him to Fellowship, and the College of Physicians did the same.

He then made a voyage to Jamaica, upon whose fauna and flora he later became an authority. He then settled in London where he became physician to Christ's Hospital, the salary for which service he returned to the institution, as he was a man of independent wealth. He next took a medical degree at Oxford and was appointed physician to Queen Anne. In 1716 George I made him a baronet, the first physician to have that honor conferred upon him. Next he became president of the College of Physicians, and at Newton's death, president of the Royal Society.

In 1712 he purchased Chelsea Manor, which estate included the Chelsea Physic Garden, and in 1722, out of gratitude to the Apothecaries for the thoroughness of his early training he presented the Garden to the Apothecaries' Society. Sloane was a skilled physician who was free from many of the prejudices of the physicians of his time, which is attested by the fact that he, like Sydenham, who was a broad-minded practitioner

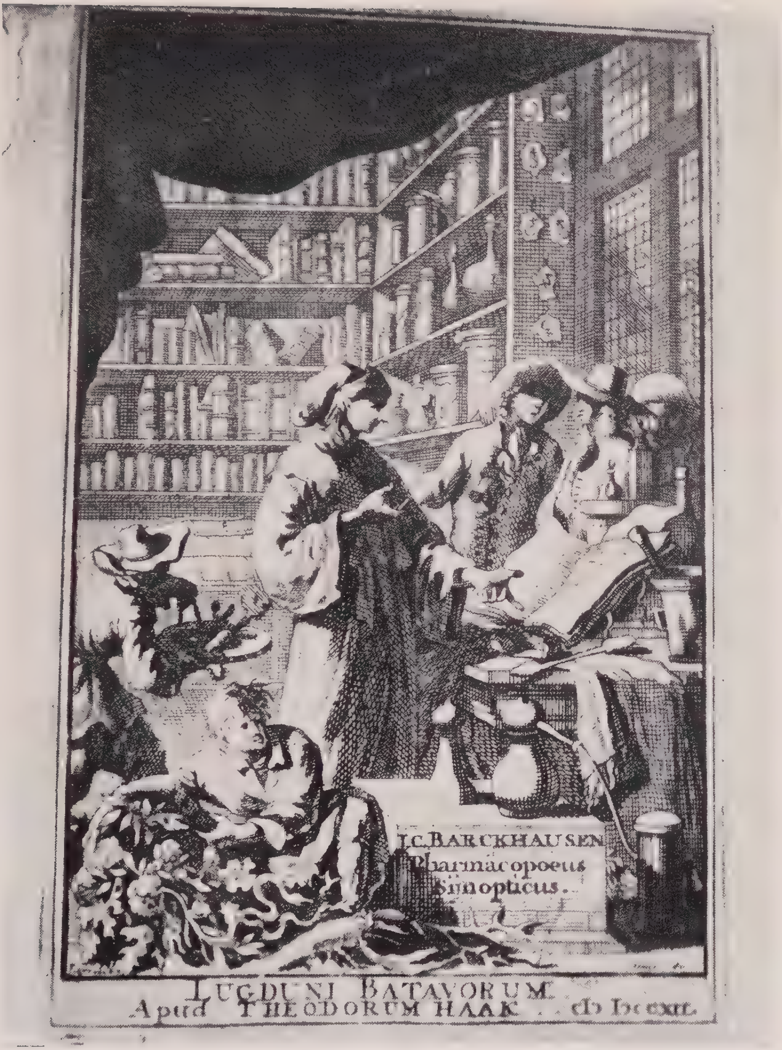


FIG. 44.—FRONTISPIECE OF BARCHUSEN'S *Synopsis of Pharmacy*, SHOWING A PICTURE OF A LATE SEVENTEENTH CENTURY PHARMACY. SEE PAGE 358.

of the previous century, was quickly convinced of the virtues of Peruvian Bark and made good use of it in his practice.

In this respect and in many others Sir Hans differed from the average seventeenth century physician, who is graphically described by Garrison as "a sterile pedant and coxcomb, red heeled, long robed, big wigged, square bonnetted, pompous and disdainful in manner, making a vain parade of his Latin, and instead of studying and caring for his patients, trying to overawe them by long tirades of technical drivel, which only concealed his ignorance of what he supposed to be their diseases." Garrison also says, "Nearly every one of the great physicians of that time stood on a pedestal all his own and many of these let it be known that they were in possession of private or secret remedies which were superior to all others."

Sir Hans Sloane's single contribution of direct importance to pharmacy was his paper on St. Ignatius' Bean, presented to the Philosophical Society. He lived to the ripe age of ninety-three, and died full of days, riches, and honors and bequeathed his great and varied collections, valued at a sum equivalent to half a million dollars, to the nation, with the exception of comparatively small bequests to his daughters, which he had

stipulated should be paid in cash by the nation so that his museum might be kept intact. The British Government was loath to accept what seemed to some of the trustees to be a white elephant. Horace Walpole, the English author and wit, was one of the trustees and wrote the following letter on the subject to Sir Horace Mann:

> February 14, 1753. You will scarce guess how I employ my time; chiefly at present in the guardianship of embryos and cockleshells. Sir Hans Sloane is dead, and has made me one of the trustees to his museum, which is offered for twenty thousand pounds to the King (or) Parliament (or on refusal) to the Royal Academies of Petersburg, Berlin, Paris and Madrid. He valued it at fourscore thousand, and so would anybody who loves hippopotamuses, sharks with one ear, and spiders big as geese. You may believe that those who think money the most valuable of all curiosities will not be the purchasers. The King has excused himself, saying that he did not believe that there are twenty thousand pounds in the Treasury. We are a charming wise set, all philosophers, botanists, antiquarians and mathematicians; and adjourned for our first meeting, because Lord Macclesfield, our chairman, was engaged to a party for finding out the longitude.

After spirited discussion Parliament decided to accept the bequest and the British Museum of today is the result of that nucleus of Hans Sloane's collection, which contained 50,000 books and manuscripts, 23,000 coins and medals, 3000

antiquities and gems and 16,000 natural history specimens.

The British Parliament acted with more wisdom than did the authorities of the city of Philadelphia in the matter of Bartram's Garden. John Bartram was an early American botanist, who in 1715 established the first botanical garden in the new world, on the banks of the Schuylkill. In these twelve acres he had accumulated hundreds of plants collected by himself on exploration trips made afoot and on horseback, which covered the entire eastern portion of the United States. This extensive collection of new-world plants became, during the eighteenth century, the seminary of American botany and the plants from there were sent to scientists and to botanical gardens all over Europe. In the early part of the nineteenth century it was known as the Botanic Garden of America. It was given by the descendants of John Bartram to the city of Philadelphia some years ago with the result that it was so neglected as to become an almost barren waste and efforts are now being made to restore it, when the expenditure of half the money and energy at first would have sufficed to retain it as a Mecca for botanists.

The eighteenth century is the period when Molière, the French author, so caustically holds

up to ridicule the pedantry and ineptitude of the French physician. The army surgeons in Prussia during this same century were ranked slightly above the drummers and beneath the chaplains, and were required to shave the officers upon request.

Pharmacy in the United States in the early colonial days is well described in that excellent historical volume called *The First Century of the Philadelphia College of Pharmacy,* by the editor, Joseph W. England, as follows:

In the nature of the case the conditions in America, far from the marts of the world, sparsely populated, newly settled, were distinctly worse than in England. The circumstances under which the colonists had begun their life on this continent made it difficult to obtain physicians save only in large towns. At first preachers, while they traveled from settlement to settlement to comfort the sick spiritually, often administered medicines. They could apply ointments and plasters, dress a wound and dose a suffering creature with calomel, ipecac, jalap, and tartar emetic. Mothers kept for their children a variety of household remedies, knowledge about which had been handed down from generation to generation. Neighbor nursed neighbor in illness. There was a midwife for lying-in patients. Each community was likely to have some matron who would gather, sell and prescribe "yarbs," and a man more deft or perhaps only more audacious than his neighbor, who would cup and bleed, or draw an aching tooth. Jimson weed was smoked in a pipe for asthma. Pokeberries, when ripe and

the juice dried in the sun, were made into a plaster for cancer. Sour dock root was made into an ointment for tetter. Catmint tea was used for colic, sassafras root as a purifier of the blood; grapevine sap to make the hair grow; boneset for consumption. From a few boxes or jars in a corner of the general store, customers might be supplied with Glauber's salt, cream of tartar, mustard, flowers of sulphur, and castor oil.

Where there were physicians, they were at best not very skilled advisers. The science of medicine was of slow growth and schools for the training of physicians were few even in Europe. The whole healing art continued in this country, as in the Old World, to be confused with a mass of credulity and superstition which could be only slowly dispelled from the popular mind. Tales of cures passed from tongue to tongue. When newspapers appeared they gave currency to many an account of miracles wrought by preposterous methods, as did the almanacs.

It was not far to go from the hair of a dog to cure its bite, and dung plaster for a wound or an ache, to the pills and swills of the patent medicine man. Nostrums are supported by the same psychology, but the one of secret composition, the names and nature of whose ingredients are sedulously concealed, is the more insidious, on which account, as the maker and vendor knows, they are certain to yield him the greater income. The very mystery surrounding their manufacture makes it the more possible to play upon popular credulity. He was early on the ground. His "sovereign remedy" or "sure specific" would be accompanied by a list of three score diseases, which it was "warranted" to cure. Supplied with the King's patent, sealed and delivered in the presence of the proprietor, who

added his autograph to the wrapper in attestation of the genuineness of the mixture, with the endorsement of the "whole eminent faculty," and signed testimonials of cures from fictitious persons, or if not fictitious, from men whose statements of approbation were forged, the situation was one to disturb—if not disgust—scientific men.

The Old English "patent medicines" were as familiar as laudanum and castor oil. What they were and the purpose they served were generally known and recognized. But there were scores of new medicines to which the most astounding curative powers were ascribed and which every day were touted everywhere.

Physicians in the new world, as a rule, either compounded their own prescriptions or else employed apothecaries as assistants. They imported such European drugs and preparations as they needed and used the indigenous drugs whose properties they learned from the Indians. In this way there came into the materia medica of the later pharmacopœias such drugs as apocynum, first called American Indian Hemp or Canadian Hemp; caulophyllum, called squaw root or papoose root; euonymous, of which the Indian name "wahoo" still persists as a synonym; hydrastis, called yellow puccoon or golden seal; lobelia, called Indian tobacco; podophyllum, called May apple or mandrake; sassafras; sanguinaria, called red puccoon or bloodroot; ulmus, called slippery elm or salve bark, and many others.

FARMACOPEA UNIVERSALE CHE CONTIENE

Tutte le Composizioni di Farmacia le quali sono in uso nella Medicina, tanto in Francia, quanto per tutta l'Europa, le loro Virtù, Dose, e Maniere di mettere in pratica le più semplici e le migliori

E di più un Vocabolario Farmaceutico, molte nuove Osservazioni, ed alcuni ragionamenti sopra ogni Operazione

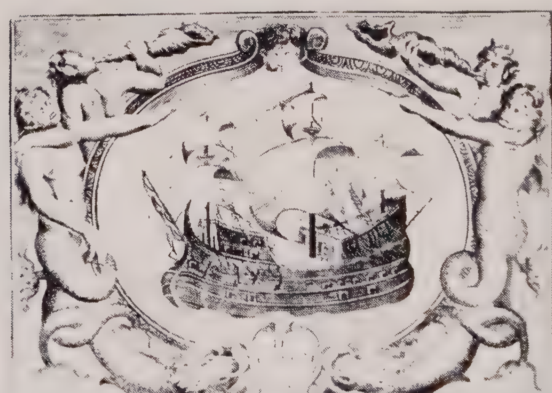
D I

NICCOLO LEMERY

Dell'Accademia Reale delle Scienze, Dottore in Medicina

TRADOTTA DALLA LINGUA FRANCESE

Con tre Indici, uno de' Capi, l'altro delle Materie, e'l terzo delle Infermità, alle quali quivi si trovano preferiti i P...



IN VENEZIA. MDCCXX.

... Gio. Gabriel Hertz

FIG. 45 —TITLE-PAGE OF ITALIAN EDITION OF LEMERY'S *Universal Pharmacopoeia*, 1720. SEE PAGE 304.

Many were the drugs employed by the American Indian. Dr. Benjamin Rush of eighteenth century fame, collected a lot of data regarding them and in our own time Prof. Heber Youngken has published several interesting and valuable articles, the list of such drugs running into the hundreds.

The physician-apothecaries of that day employed characteristic signs, as was the custom in Europe. Among these were the *Golden Ball,* the *Pestle and Mortar,* the *Unicorn,* the *Ointment Pot,* the *Bell,* the *Dove,* the *Dragon,* the *Deer,* the *Hippocrates,* the *Boerhaave,* the *Glauber,* etc. Apprentices served terms with these men of from three to six years, devoting their time partly to books, partly to the study of anatomy, and partly to the compounding of medicines. The extract kettle was always simmering on the hearth and the clang of the iron contusion mortar and pestle resounded throughout the land. The physicians or their apprentices gathered the simples in their seasons and either dried them or made them up immediately into stock preparations. Advanced students attended to cupping and leeching, tooth pulling and the dressing of minor wounds.

Photographs of an indenture of the late eighteenth century is given in illustrations No.

51, opposite page 456. This indenture is in the possession of the Library of the Philadelphia College of Pharmacy and Science, and the apprentice named in the indenture was an ancestor of Professor Joseph P. Remington, for many years one of America's leading pharmacists.

At the close of the apprenticeship the preceptor gave the pupil a certificate of proficiency and the youth was then ready to enter medicine or pharmacy, or both, on his own account. Some few returned to London, Edinburgh, or Leyden to study, as did Doctor Morgan, of whom we shall presently hear more, for he was destined to play an important part in the development of American pharmacy. It is estimated that within a period of thirty years, between 1760 and 1790, sixty-three Americans were graduated at Edinburgh alone.

There was quite a scandal in connection with degrees from Edinburgh at about this time. It had been the custom of this University to grant degrees *in absentia* to any person who could get the approval of two practicing physicians and their endorsement. In 1773 there was a protest against this practice in the shape of a memorial by a celebrated London physician of that time, Dr. William Cullen. The matter was referred to Adam Smith the noted economist, who wrote a

masterly treatise on medical education in connection with the protest, and this was published several years before his celebrated *Wealth of Nations.*

Doctor Ruschenberger, the historian of the College of Physicians of Philadelphia says:

Any physician who had gained a measure of success in a community surrounded himself with apprentices. As the lawyer trained his own assistants, so did the doctor take in young men who wished to prepare themselves for the "practice of physic." These medical apprentices became proficient in the use of the mortar and pestle for powdering a drug, in extracting a tincture in a kettle on the hearth, in rolling a pill on a slab, and in spreading a plaster. It is related that three of the apprentices of Doctor Rush, during the yellow fever epidemic of 1793, were employed night and day in putting up powders of calomel and jalap, or calomel and rhubarb, the remedies which he so generally used in combating that dread disease.

Now and again a physician would open a little dispensing shop and offer his preparations for sale. This was tended by the apprentices who after five or six years of menial and poorly remunerated service might qualify themselves to engage in the unregulated and unlicensed business of medicating the community on their own account.

M. I. Wilbert in a splendid account of the beginnings of pharmacy in America, says:

The first record we have of the appointment of an apothecary to fill prescriptions other than his own or those of his preceptor, is to be found in "Some Account of the

Pennsylvania Hospital from Its First Beginning to the Fifth Month, called May, 1754," written by Benjamin Franklin, then the clerk or secretary of the Board of Managers of the Pennsylvania Hospital. In this little pamphlet we find the following paragraph:

"The practitioners charitably supplied the medicines gratis until December, 1752, when the managers, having procured an assortment of drugs from London, opened an apothecary's shop in the hospital; and it being found necessary, appointed an apothecary to attend and make up the medicines daily, according to the prescriptions, with an allowance of fifteen pounds per annum for his care and trouble, he giving bond, with two sufficient sureties for the faithful performance of his trust."

Jonathan Roberts, who was warmly recommended by Doctor Bond, was appointed as the first apothecary to the hospital, and served the institution faithfully and well until the spring of 1755, when he resigned to accept more remunerative employment.

John Morgan, who was an apprentice of Dr. John Redman, succeeded as the second apothecary at the Pennsylvania Hospital. He was appointed on May 19, 1755, and served until the following spring, when he resigned.

Quoting again from *The First Century of the Philadelphia College of Pharmacy,* we have:

In 1757 John Morgan graduated from the College of Philadelphia (founded by Benjamin Franklin about the middle of the eighteenth century), receiving a collegiate degree, and in 1760 went to Europe to complete his medical education.

In 1765, having completed his studies in London, Edinburgh, and Paris, he returned from Europe and

"founded the first medical school attached to any college or university in this country" (Edgar Fahs Smith)—the Medical School of the College of Philadelphia. The medical department of the University of Pennsylvania was established in 1779, and in 1791 these two medical schools, by act of the Pennsylvania Legislature, were united under the University of Pennsylvania.

In addition to the part he played so honorably as a pioneer in medical education in this country, Dr. John Morgan, after his residence in England, and particularly in France, where pharmacy enjoyed an early and notable development, became a spirited advocate of the separation of pharmacy from medicine. While in Europe he wrote, "I am now preparing for America, to see whether, after fourteen years devotion to medicine, I can get my living without turning apothecary or practitioner of surgery." At the very beginning, in his "Discourse Upon the Institution of Medical Schools in America," delivered at the commencement of the College of Philadelphia, May 30–31, 1765, he said:

"We must regret that the very different employment of physician, surgeon and apothecary should be promiscuously followed by any one man. They certainly require very different talents.

"The business of pharmacy is essentially different from either, free from the cares of both, the apothecary is to prepare and compound medicines as the physician shall direct. Although engaged in this, by length of time, he attains to that skill therein which he could never have arrived at were his attention distracted by a great variety of other subjects.

"The wisdom of ages approved by experience, the most

certain test of knowledge, has taught us the necessity and utility of appointing different persons for these different employments, and accordingly we find them prosecuted separately in every wise and polished country.

"The paying of a physician for attendance and the apothecary for his medicines apart, is certainly the most eligible mode of practice both to the patient and practitioner. The apothecary, then, who is not obliged to spend his time in visiting patients, can afford to make up medicines at a reasonable price, and it is as desirable as just in itself that patients shold allow fees for attendance—whatever it may be thought to deserve.

"They ought to know what it is they really pay for their medicine and what for medical advice and attendance."

Morgan's recommendations, however, did not meet the approval of his contemporaries. The drug store, when it existed at all, was only a warehouse from which the physician might obtain his supplies; druggists were mere warehousemen and dealers. Not until that picturesque figure of our medical history, Dr. Abraham Chovet, came to the city from Jamaica, was there one in town who would adopt the plan of writing prescriptions for his patients. Dr. John Jones followed, and by the end of the eighteenth century the custom was rather general, not only in Philadelphia, but in the other cities of the colonies. The apothecary thus came to occupy his own separate place in the community, and though as yet a man of no great standing, in such a manner were the foundations of pharmacy established. The course pursued by Doctor Morgan, Doctor Carson has stated, may be said to have given the original impulse to the cultivation of the profession of pharmacy and sanctioned its independent existence.

M. I. Wilbert has written of John Morgan, the pharmacist-physician, as follows:

"Doctor Morgan was undoubtedly the first teacher of the theory and practice of medicine, materia medica, pharmacy and pharmaceutical chemistry in America. That he taught all of these branches appears from the announcement of the first course of lectures in the College of Philadelphia, quoted from the *Pennsylvania Gazette* for September 26, 1765, as follows:

'A course of lectures on Materia Medica, by John Morgan, M.D., etc. Price four pistoles.

'The course will commence on the eighteenth day of November, and will be given three times a week at the college, at three o'clock in the afternoon, till finished, which will last between three and four months.

'To render these lectures as instructive as possible to students of physic, the Doctor proposes, in the course of them, to give some useful observations in general, and the proper manner of conducting the study of physic.

'The authors to be read in materia medica will be pointed out. The various substances made use of in medicine will be reduced under classes suited to the principal indications in the cure of diseases. Similar virtues in different plants, and their comparative powers, will be treated of and an inquiry made into the different methods which have been used in discovering the qualities of medicines; the virtues of the more efficacious will be particularly insisted upon; the manner of preparing and combining them will be shown by some instructive lessons upon pharmaceutic chemistry and pharmacy. To prepare them more effectually for understanding the art of prescribing with elegance

and propriety, if time allows, it is proposed to include in this course some critical lectures upon the chief preparations contained in the Dispensatories of the Royal College at London and Edinburgh. The whole will be illustrated by many useful and practical observations on diseases, diet and medicines.' "

This rather comprehensive announcement was followed in 1766 by another, which read in part:

A course of lectures on the "Theory and Practice of Physics" will be delivered for the benefit of Medical Students, with a preparatory course of Botany, Chemistry, and Materia Medica, being the substance of a set of lectures delivered to his pupils last winter.

That Morgan had been the acknowledged teacher of chemistry in the Medical School of the College of Philadelphia would also appear from the following letter, written by Doctor Rush, as an application for the chair of chemistry:

"Gentlemen. As the professorship of chemistry which Doctor Morgan has sometime supplied is vacant, I beg to offer myself as a candidate for it.

Should you think proper to honor me with the chair, you may depend upon my doing anything that lies within my power to discharge the duties of a professor, and to promote the reputation and interests of your college.

I have the honor to be, with the greatest respect,

Your most obedient humble servant,

Benj. Rush.

Philadelphia, July 31, 1769."

Doctor Morgan was one of the founders of the first medical society in the Province. This was the Philadelphia Medical Society, organized February 4, 1765. Several years later this society was united with the American Society for Promoting Useful Knowledge, and this, in 1769, was united with the Philosophical Society to form the American Philosophical Society.

Doctor Morgan had brought a prescription pharmacist to America with him, whose name was Leighton, and whose stock was purchased from two celebrated English firms. Concerning Leighton's ultimate fate we know nothing, as he is never referred to later.

Following the French and Indian War of 1763, the members of the medical staff of the British Army remained for several years with the army of occupation and gave professional instruction in medicine and pharmacy to all who cared to avail themselves of the opportunity.

At the time of the war for American Independence there were about 500 holding European degrees, it is said, out of a total of 3500 physicians in the colonies. One contemporary commentator said:

> Few physicians amongst us are eminent for their skill. Quacks abound and too many have recommended themselves to a full and profitable practice and subsistence. Any man

at his pleasure sets up for physician, apothecary, or chirurgeon. No candidates are examined or licensed. In Connecticut where a movement was instituted to require physicians to pass an examination for permission to practice, the Assembly decided in favor of the irregulars and against any "monopoly in the practice of medicine."

This sounds strangely familiar and both the action of the legislature and the comment might have occurred in our twentieth century period of advancement.

In 1775 the American Congress gave official recognition of the importance of the apothecaries' work, for in establishing a hospital for the Federal army, which then consisted of 20,000 men, they provided for one director-general and chief physician at $4.00 per diem, four surgeons, at $1.34 per diem, and one apothecary at $1.34 per diem. The surgeons, apothecary and mates were to visit and attend the sick, and the mates were to obey the orders of the physicians, surgeons, and apothecary. The ratio between the surgeons and apothecaries seemed to have changed somewhat in the last hundred and fifty years.

Hugh Mercer was a physician and apothecary in what was then called Greencastle, Pennsylvania, and is now called Mercersburg, about the middle of the eighteenth century. He took an active part in the early military activities of

FIG. 46.—PICTURE OF NICHOLAS LEMERY, FROM ONE OF HIS EIGHTEENTH CENTURY WORKS. SEE PAGE 304.

the colony and was wounded in the battle of Fort Duquesne, when General Braddock was killed. He formed a friendship with George Washington, the loyal colonial, at this time.

Mercer later went to Fredericksburg, Va., and opened an apothecary shop with a partner named Clement, who was later succeeded by a man named Julian. In this pharmacy, which was a prominent one in its day in that section, George Washington made himself at home on his frequent visits to that town, and is said to have had a desk in Mercer's store from 1764 to 1776, where he transacted all of his business when he came there.

Mercer the pharmacist later became Brigadier-General Mercer of Revolutionary fame, and in 1777 Congress approved the erection of a monument to his memory at Fredericksburg and authorized the following inscription:

> "Sacred to the memory of Hugh Mercer, Brigadier-General in the Army of the United States. He died on the 12th of January, 1777, of the wounds he received on the 3d of the same month, near Princeton, N. J., bravely defending the liberties of America. The Congress of the United States, in testimony of his virtues and their gratitude, has caused this monument to be erected."

The monument was erected in 1902, one hundred and twenty-five years later, when the report

was resurrected from its files in Congress. Congress has never had the reputation of exceeding the speed limit in matters of this kind.

An eminent Philadelphia apothecary, Christopher Marshall, who practiced pharmacy exclusively at the sign of the Golden Ball on Chestnut Street in that city, was commissioned by the Continental Congress in 1776 to look after the pharmaceutical needs of the wounded soldiers in the Philadelphia hospitals. At this same time an apothecary-general was provided for the United States army, who was as supreme in his authority as the surgeon-general in his field, and this position was continued for upward of fifty years.

In 1778 there was a " doctors' riot " in New York. This was occasioned by the rumors that zealous medical students were looting graves of persons who had been recently buried, in the cemeteries, and were selling the bodies to physicians who were interested in anatomical research. One of the New York hospitals was almost wrecked by a mob and had to be protected by the sheriff who lodged the doctors in the jail for their own safety. These riots continued for some days, the militia had to be called out, and a number of deaths occurred in the violence of the fighting.

The first pharmacopœia in America was pub-

lished in Philadelphia in 1778. It was printed entirely in Latin upon thirty-two pages, the text occupying a space of four and one-half by two and one-half inches (see illustration No. 53, page 472). It was compiled by Dr. William Brown, Physician-General to the Hospitals of the United States, at the Continental Hospital located in Lititz, Lancaster County, Pa. It was announced as being " for the use of the Military Hospital belonging to the Army of the United States of America. Adapted to our present state of need and poverty, which we owe to the ferocious cruelty of the enemy, and to a cruel war brought unexpectedly upon our Fatherland." A second edition of this work appeared in 1781.

After the American Revolution, some of the Hessian physicians of the British Army remained in America. One of these, a Doctor Schoepf, wrote the first *Materia Medica Americana*, which was publisehd in Latin in 1787. He also wrote a narrative of his travels, which gives a picture of medicines and of pharmacy at that time. He was partial to the new world drugs, it would seem, for he says: " It shows unpardonable indifference toward the blessings of their country in medicinal plants when it is manifest that they almost entirely depend in their practice on imported ones." He expresses his pleasure

at having met with a German pharmacy in Philadelphia.

An early American naturalist was the physician and botanist, Dr. Benjamin Smith Barton, whose *Flora Philadelphica* is a classic, and whose essays on articles of the indigenous materia medica helped to awaken interest in this subject.

A number of foreign naturalists visited America during the eighteenth century, among whom were Wilson, Audubon, Kalm, and Nuttall.

A directory of prominent inhabitants in New York city in 1703, reveals the name of John Tagree, an apothecary. One of the early governors of the colony of New York, Governor Hunter, who ruled from 1710 to 1720, was an apothecary of note at the time. Soon after this the Van Buren family commenced the practice of pharmacy, both in New York and the city of New Brunswick, N. J. John Johnstone was a pharmacist at Perth Amboy, N. J., early in the eighteenth century. He was an active public character of his time and some of his descendants were said to be still actively engaged in the practice of pharmacy a hundred years later.

In 1711 the first American patent medicine appeared. It was called "Tuscarora Rice," and was sold by a Mrs. Masters as a consumption

cure. This was the period of traveling Indian medicine men and peripatetic quacks. The New Jersey State Medical Society in 1772 had a law passed prohibiting both the practice of the healing art and the sale of medicines by "mountebank doctors."

An early compilation of pharmaceutical lore was a *Collection of Receipts,* published in 1755 by Robert Eastburn of New Brunswick, N. J. *Salmon's Herbal* and his other books still continued to be popular reference books nearly one hundred years after their first appearance in England in the previous century. In one of the eighteenth century editions the following note appeared in the preface to one of these remarkable if not particularly valuable works:

> I know that I have many enemies in the world and that the publishing of this work will create me many more, and these powerful ones, and malicious too; but I have overlookt all this and have directed my eye to the recompense of reward. If therein I have served my country and generation, I have what I aimed at, and I am sure I have along with it the blessings of the poor and needy, and the defense of Him, whose mercies are over all His works.

An interesting lot of history is connected with the origin of some of the pharmaceutical preparations of the present which had their source in the eighteenth century. Aromatic spirit of ammonia appeared first in the P. L. of 1721, under the

title of *Spiritus Salis Volatilis Oleosus.* In 1746 the title was changed to *Spiritus Salis Ammoniaci Dulcis.* The title was again changed in the revision of 1788 to *Spiritus Ammoniæ Compositus,* and not until the edition of 1809 was the present title adopted. Jacob Sylvius, the great sixteenth century pharmaceutical commentator, is credited with its original introduction under the name *Spiritus Carminativus Sylvius.*

Compound rhubarb powder originated in a frequently prescribed combination of Dr. James Gregory, an eighteenth century English physician. It was known by the synonym " Gregory's Powder " for many years in the pharmacopœias to which it was admitted.

Compound tincture of lavender was originally called " Palsy Drops," and was admitted to the P. L. of 1721 with a formula calling for French brandy and twenty-seven other ingredients, mostly aromatics.

Compound tincture of benzoin, which had been known as " Jesuit's Drops " and had appeared in many unofficial pharmacopœias in the seventeenth century, acquired official standing in the P. L. of 1746, under the name " Traumatic Balsam." In this century, too, it acquired the synonyms " Turlington's Drops," " Turlington's Balsam " and " Balsam de Maltha."

Compound licorice powder first appeared in the *Prussian Pharmacopœia* of 1799, but it was really a modification of a preparation in the first P. L. of 1618, which had been called Compound Senna Powder, certainly a name much more in harmony with modern ideas of proper nomenclature.

Just when the name " Opodeldoc " came to be first applied to a form of soap liniment cannot be ascertained with certainty. Paracelsus first used the term which he spelled " Opodelloch." This title was applied to a plaster. An ingenious explanation of the origin of the name is given in Peters' *History of Pharmacy.* The plaster had three principal ingredients, opoponax, bdellium, and aristolochia. Peters says the name was derived from the first two syllables of the first ingredient, the second syllable of the second ingredient, and the third syllable of the third ingredient.

There was an Unguentum Opodeldoch in the first *Edinburgh Pharmacopœia* of 1722. This ointment contained a number of drugs, but it also contained camphor and soap, so the name may have been applied later to a spirituous preparation of the same character.

Compound pills of antimony originated from a formula devised by Dr. Andrew Plummer, an

English physician who published his formula in 1751. The name "Plummer's Pills" later came to be associated with the compound calomel pills of the *Edinburgh Pharmacopœia* of that century.

Compound opium pills, consisting of opium with soap as an excipient were official in the P. L. of 1746 under the misleading title of *Pilulæ Saponacea.* This formula was originally derived from famous nostrums sold under the names of "Matthew's Pills" and "Starkey's Pills," both of which appeared in the seventeenth century and corresponded to this formula. The name was later changed, first to *pilulæ saponis compositæ* and later to *pilulæ saponis cum opio.*

Compound decoction of sarsaparilla had its origin in a remedy for syphilis, called Lisbon Diet Drink, which appeared in the eighteenth century. The preparation was introduced into the P. L. of 1788 under its present title. *Sirop de cusenier* was the title of a similar French preparation of the eighteenth century. A German physician named Zittmann had popularized the same preparation in Germany about the same time, where it came to be known as Zittmann's Decoction.

Calamine (Turner's) cerate was invented by

Daniel Turner, M.D., a London surgeon in the early part of the eighteenth century.

Compound tincture of gentian had its beginning in a nostrum called "Stoughton's Great Cordial Elixir," for which letters patent were granted in 1712, the second medicine for which a patent was granted, the first one being the *sal oleosum volatile* referred to in the nostrums of the seventeenth century.

Bateman's Pectoral Drops, now official in the National Formulary under the title of Compound Tincture of Opium and Gambir, was another nostrum for which letters patent were granted in 1726 to Benjamin Okell.

Hooper's Female Pills also originated as a nostrum patented by John Hooper, apothecary of Reading, England, in 1743.

Compound antimony powder was admitted to the P. L. in 1788. It was first introduced as a secret nostrum by Dr. Robert James, a celebrated English physician of the eighteenth century, who patented it in 1747. Complaints were made at the time that the patent specifications were faulty and that nobody but Doctor James himself could successfully make the preparation. The formula adopted in the P. L. was based upon an analysis of the patented nostrum made

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by a pharmacist named Higgins, working in the laboratory of the Society of Apothecaries.

Doctor James was a voluminous contributor to the medical and pharmaceutical literature of his time and published a comprehensive work under the title *Pharmacopœia Universalis.*

Godfrey's Cordial, known in the National Formulary IV as Mixture of Sassafras and Opium, was a popular household remedy in Great Britain in 1722, when an advertisement of it appeared, announcing the transfer of the formula to John Humphreys, Apothecary, by the estate of Thomas Godfrey, deceased.

Wine of colchicum corm is the outcome of a French proprietary remedy of the eighteenth century, which was called *eau medicinale d'Husson.* It was used in the treatment of gout. The original preparation was put up in bottles holding two fluidrachms (the dose was directed as one fluidrachm, to be repeated in from four to six hours, if necessary), and sold at the equivalent of $5 a bottle.

Compound tincture of cinchona (Huxham's Tincture) was devised by John Huxham, M.D., of Plymouth, England. Doctor Huxham was an highly educated specialist, who had studied at Leyden under Boerhaave and also at Rheims. He was elected to Fellowship in the Royal Society

of London in 1739 and was awarded the Copley medal in 1755, for a treatise on anatomy in which he proposed a remedy made by digesting metallic antimony with wine, the prototype of our present wine of antimony made with tartar emetic. The formula for his cinchona preparation was given in connection with an essay on fevers in 1755. The formula appeared in the P. L. in 1788. Huxham must have been a prescriber of the old school and one of his prescriptions would give a modern pharmacist a fit, for Paris, in his *Pharmacologia* states that Huxham's prescriptions frequently called for several hundred ingredients, and one for more than four hundred.

Infusion of digitalis (Withering's Infusion) was popularized by Dr. William Withering of Birmingham, England, who wrote "an account of the Foxglove and some of its medical uses" in 1785. Doctor Withering died in 1799 at the age of fifty-eight. A foxglove was carved on his monument in Old Church, Edgbaston.

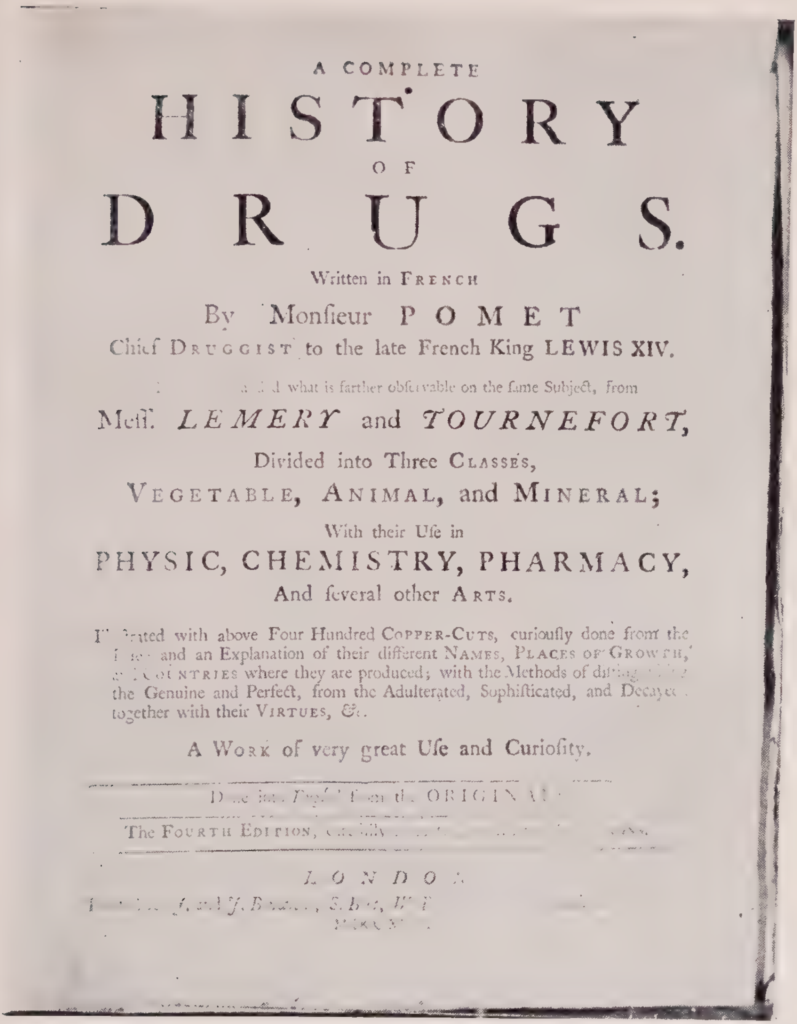
Compound tincture of senna was a celebrated nostrum of the first decade of the eighteenth century under the name of Daffy's Elixir, which is still used as a synonym for this preparation. The same Benjamin Okell who manufactured Bateman's Drops also made and sold this preparation. The original Reverend Doctor Daffy was a prac-

titioner of the seventeenth century, and was a rector in Leicestershire.

Vinegar of opium, which has disappeared from the American books of standards, was known in the first half of the eighteenth century under the name of "Black Drop," and was a celebrated proprietary remedy. It was also known as the Lancaster or Quaker's Black Drop. The preparation as originally made was three times the strength of laudanum, and was made by a complicated formula in which the juice of wild crab-apples was used, and which was subsequently fermented for several months after the addition of yeast.

Paregoric is another opium preparation in which the name has been found to be associated with a number of medicines of a character distinctly different from the paregoric of today. The present preparation originated with Doctor LeMort, Professor of Chemistry at the University of Leyden (1702–1718). The formula, as given in the *London Pharmacopœia* of 1721, under the Latin title *elixir asthmaticum,* contained opium, honey, licorice, benzoic acid, camphor, oil of anise, potassium carbonate, and alcohol.

Later the title of *elixir paregoricum* was applied to this preparation, and during the two


A COMPLETE

HISTORY

OF

DRUGS.

Written in FRENCH

By Monſieur POMET

Chief DRUGGIST to the late French King LEWIS XIV.

[illegible] what is farther obſervable on the ſame Subject, from

Meſſ. *LEMERY* and *TOURNEFORT*,

Divided into Three CLASSES,

VEGETABLE, ANIMAL, and MINERAL;

With their Uſe in

PHYSIC, CHEMISTRY, PHARMACY,

And ſeveral other ARTS.

[illegible]ated with above Four Hundred COPPER-CUTS, curiouſly done from the [illegible] and an Explanation of their different NAMES, PLACES OF GROWTH, [illegible] COUNTRIES where they are produced; with the Methods of [illegible] the Genuine and Perfect, from the Adulterated, Sophiſticated, and Decaye[illegible] together with their VIRTUES, &c.

A WORK of very great Uſe and Curioſity.

[illegible] ORIGINA[illegible]

The FOURTH EDITION, [illegible]

LONDO[illegible]

[illegible]

FIG. 47.—TITLE-PAGE OF ENGLISH TRANSLATION OF POMET'S *History of Drugs*, 1748, A WORK FIRST PUBLISHED IN FRANCE IN 1691, WIDELY TRANSLATED AND REPUBLISHED DURING THE EIGHTEENTH CENTURY. SEE PAGE 307.

hundred years that have intervened since it was originated it has suffered many changes both in composition and nomenclature. The title "Paregoric," instead of being the Latin, has become the English name. This name was used back in Greek and Roman times, and throughout the intervening period as a generic term meaning an anodyne, from the Greek *paregoricon* (soothing), applied originally to oratory.

In the *Pharmacopœia Schroedero-Hoffmanniana* (1687) it is stated in the introductory portion of the book that paregoric is an anodyne, and later, under *tinctura anodyna* (but without the synonym paregoric), a formula is given for a preparation containing opium, benzoin, saffron, alcohol, castor, and salt of tartar. It is probable that this formula was taken by LeMort as the basis for the preparation credited to him.

Both paregoric and laudanum were given titles that seem to have been used, respectively, for a variety of preparations up to within very recent times. A *Pharmacopœia Universalis* (1846), compiled officially by the authorities of Weimar, as the fourth edition of a similar work first issued in 1828 by Jourdan of Paris, contains formulas for over forty different kinds of laudanum, and more than twenty different kinds of paregoric. All of these preparations have opium

as the common ingredient, but the variations in other respects cover a very wide range. The authorities quoted in this compilation number more than one hundred and cover a chronological range of over fifty years, beginning with the *Amsterdam Pharmacopœia* of 1792.

If Thomas Dover had not been at one time a devoted servant of the famous Doctor Sydenham of laudanum fame, he probably would not have been filled with an ambition later to call himself a physician, for that was all that was needed in those days in Merrie England to practice medicine, and the world would never have heard of Dover's Powder, and might never have had the benefit of this valuable remedy; and if this same Thomas Dover had not turned buccaneer for a few years the story of Robinson Crusoe would never have been written, for it was Captain Thomas Dover on the privateer "Duke" who rescued Alexander Selkirk on February 2, 1709, after he had lived alone on an island for more than four years, and whose story so appealed to DeFoe that the world gained a classic piece of literature.

Dover's privateering venture ended in 1710 with great profit, as he came back with a ship full of treasure in addition to a Spanish frigate of twenty-one guns, which he had captured. Although nearly forty years of age he shortly there-

after embarked upon the practice of medicine and became a free lance in the field, calling the College of Physicians " a clan of prejudiced gentlemen," and complaining of the extortionate charges of the apothecaries of his day.

He was a successful and popular practitioner for many years and before he died wrote a book called *The Ancient Physician's Legacy to His Country,* which was a record of the cures that he had accomplished together with the remedies that he had used, and it was in this book that he describes the " diaphoretic," or sweat-producing powder, as he calls it, which was made by a much more complicated process than is used today, but in which the essential ingredients have been retained in their original proportions—unusual for a remedy nearly two hundred years old, as is this one.

Dover was a fearless practitioner in the matter of doses. He gave metallic mercury in such large amounts that he was known as the " quicksilver doctor." The modern physician gives Dover's Powder in doses averaging five grains; Dover usually gave it in sixty grain doses and claimed to have given as high as one hundred grains, which is equivalent to ten grains of opium and ten grains of ipecac. It is little wonder that apothecaries

who filled his prescriptions advised his patients to make their wills before taking the medicine.

Thomas Dover died in 1742 and as physicians in general were antagonistic to his teachings and practice, his diaphoretic powder might have suffered oblivion had it not been for another celebrated character in English medical annals, who brought it into fame.

What constitutes quackery? In the case of Joshua Ward, the physician who made Dover's Powder famous, it must have been the fact that he entered the practice of medicine by the back door, as did Dover, for it is said by one of his biographers that he was originally a footman who collected the recipes that were later to make him famous, from monastery physicians on the Continent. Ward became a protegé of George II of England, when he entered the practice of medicine at the age of forty-eight, and numbered among his friends such men as Chesterfield, Gibbon, Fielding, Reynolds, and Walpole. In 1748, when a bill was introduced into Parliament restricting the practice of medicine to those who were duly qualified, it contained a clause specifically exempting Ward by name from its provisions.

He had political aspirations as well, and was at one time returned to Parliament as a member from Marlborough. Upon a contest of the elec-

tion, the Commission appointed to investigate the situation, found that Ward had not received a single vote and ordered his rival seated. The election officers in some of our large American cities of the present time must be descendants of the Marlborough electors.

Ward had a large number of secret remedies, almost all of which were powerful preparations of antimony, mercury, opium, or arsenic. Ward's Paste, Ward's Powder, Ward's Pills, Ward's Balsam, and Ward's Drops, were in more or less popular use for a century after his death, at which time his recipes were compiled by a friend and associate and published at the expense of the King, whose favor he had continuously retained. He had requested this of the King, and history shows that it was granted, but another favor that he asked was refused. It was that he be buried in Westminster Abbey " in front of the altar or as near thereto as possible." His *fel hominis* must have been of extraordinary size.

Ward had discovered the formula for Dover's most celebrated remedy in Dover's book, and had used it with effect under the resounding names of *Pulvis alexitericus, Pulvis sudorificus,* and *Pulvis anodynus.* Under the patronage of the King, he established a hospital and administered his remedies to poor people free of charge. Medi-

cal historians give but small space to either Ward or Dover. Pope embalmed the former in this illuming quotation:

> "Of late, without the least pretense to skill,
> Ward's grown a famed physician by a pill."

Another famous remedy of about this same period was that introduced by Thomas Fowler, originally an apothecary in York, who later was graduated in medicine from Edinburgh, and after practicing in several other localities, eventually went back to York and acquired a large practice. There was at that time on the market in Great Britain a patent medicine called "Tasteless Ague and Fever Drops," the originator of which is not known. Finding that this preparation was most effective, Doctor Fowler, with the help of an apothecary named Hughes, of whom Fowler says, "His industry, attention, and abilities in his professional line justly merit applause," effected the analysis of the nostrum, which he found to be an arsenical solution, and devised a formula for its duplication.

This is one of the few preparations that has suffered very little change in its composition or method of preparation since the time of its introduction by Fowler in 1786, when he published a treatise entitled *Medical Reports of the Effects*

of Arsenic in the Cure of Agues, Remitting Fevers, and Periodic Headaches. This book made Fowler's reputation and established the position of arsenic in the list of remedies of recognized value. As there was still a prejudice against the use of the salts of the poisonous metals in medicine, the result of the indiscriminate and lavish use of such remedies by physicians possessing little knowledge or judgment, Doctor Fowler suggested that the preparation be prescribed under the name of *liquor mineralis* to conceal its real origin.

Several new drugs appeared in use during the eighteenth century in addition to those whose virtues were learned from the American Indians, to which reference has already been made. One of these was quassia, which was sent to Linnæus in 1763 by one of his pupils who was traveling in South America, with the information that it was being successfully used as a secret remedy in fevers by a negro slave of Surinam. The negro's name was Quassi, and from this Linnæus derived the generic name of the plant, which, however, has since been changed, although the drug is still commonly known by that title.

It will surprise many to learn that although castor seeds were known from the time of the

ancient Egyptians, and are mentioned in the Ebers Papyrus, castor oil did not appear in the materia medica until the middle of the eighteenth century, or over 3000 years later. Its use was recommended by Doctor Peter Cavane of Bath, England, who published a dissertation on the subject in 1764 and again in 1769. It was first recognized in the P. L. of 1788.

Several purchases were made by royalty, during the eighteenth century, of secret nostrums, as had been done with ipecac and others in the previous century. Emperor Joseph II of Austria in 1785, paid 1500 florins (about $1000) for the formula of a secret febrifuge which was very popular at that time. When it was discovered to be simply a tincture of the bark of the common hedge plant called " box," it soon lost its value.

In 1775, Louis XVI paid 18,000 livres (nearly $5000) for a noted cure for tapeworm to a Madame Nouffer. She had inherited the secret from her husband who was a practicing physician in Morat, Switzerland. This was found to be simply the already well known taenifuge, male fern, which had been known since the days of Galen.

Another nostrum known as LaMothe's Golden Drops in France, and as Bestucheff's

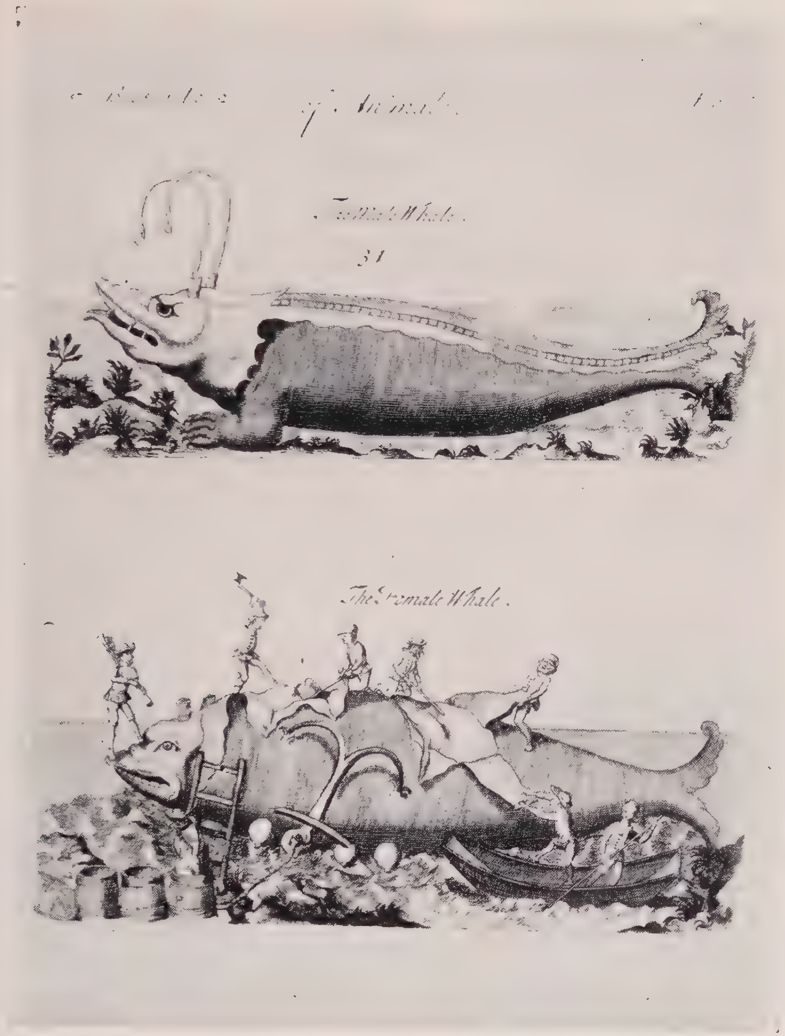


FIG. 48.— ILLUSTRATION FROM POMET'S *History of Drugs*, 1748, SHOWING THE SEVENTEENTH AND EIGHTEENTH CENTURY CONCEPTIONS OF THE APPEARANCE OF THE WHALE. SEE PAGE 307.

Tincture in Russia, was sold to two different sovereigns. LaMothe sold it to Louis XV for a pension of 4000 livres (about $1000) a year, and the right to make it exclusively for the *Hotel des Invalides.* (The preparation then sold at a price equivalent to $5 for a half ounce bottle.) Bestucheff sold it to the Empress Catharine for 3000 roubles (about $3000), and the College of Medicine of St. Petersburg published the formula under the title *tinctura tonica nervina Bestucheffi.* This preparation is official in the N.F.V. under the name of Ethereal Tincture of Ferric Chloride.

A famous remedy of the eighteenth century was tar water. This was made by extracting ordinary pine tar with cold water, which really only takes out the flavor. The preparation was lauded as a panacea for all human ills by the Right Reverend Dr. George Berkeley, Lord Bishop of Cloyne, who wrote a book upon the subject in 1744.

Kermes Mineral, later official under the name of Sulphurated Antimony, was used as a secret remedy in the latter part of the reign of Louis XIV, and was called *poudre des chartres,* and that monarch paid Glauber, its inventor, a high price for the secret in 1720.

Secrecy, mystery, and superstition have been the indispensable ingredients of many successful prescriptions and remedies from the time of the earliest Egyptians down to and including the present. The evolution of the nostrum, that blot upon scientific medicine and pharmacy, for which both professions are jointly responsible, is a separate story altogether. From these mysterious polypharmacal monstrosities, evolved by the physicians of the seventeenth and eighteenth centuries and used by them as secret remedies, has developed the modern nostrum traffic, a veritable Frankenstein taking toll in the United States alone to the extent of more than $200,000,000 annually, or enough to endow pharmaceutical and medical education and research for the permanent benefit of mankind; but the people must have their illusions at any cost, and the more intelligent people become and the greater the amount of popular education, the more credulity there seems to be about medicines. This has had a bad effect upon the practice of medicine itself, for probably in consequence of an hereditary professional inferiority complex, medicine has turned in part to therapeutic nihilism, and as a by-product of this trend has been the development of " bone bouncers " and many other well

known 'pathics and 'practics, who owe much of their practice and success to sheer audacity.

Some curious misbeliefs also developed during the eighteenth century in matters pharmaceutical. One of these was in connection with the ashes of plants which were supposed to have virtues dependent upon the particular plants from which they were obtained. Thus there was a *sal absinthii* (salt of wormwood made by burning the wormwood herb to ashes). In a similar manner were prepared *sal chamomillæ, sal gentianæ, sal baccis juniperi,* and many others. The fact that all of these products were practically identical and that they owed their qualities to the predominant ingredient, potassium carbonate, which was used and known in the very pure form of *sal tartari,* made by burning cream of tartar to ashes, seems to have entirely escaped the attention of the eighteenth century analysts.

Another prevalent error was to the effect that every substance could be made into some kind of a remedy by distillation. Thus "Oil of Bricks" was made by steeping a hot brick in oil and subsequently subjecting the oil-soaked brick to distillation.

One of the facts about cinchona which was remarked upon with some apparent surprise by

one of the early investigators, was the fact that it did not yield its virtue to distillation.

In Lemery's *Universal Pharmacopœia,* published late in the seventeenth century, and which had a great influence upon eighteenth century pharmaceutical literature, as did also the *Dictionary of Drugs* by the same author, one of the most interesting features to a modern reader is the list of definitions of pharmaceutical terms. We find that Lemery divided the subject into galenical pharmacy and chemical pharmacy. He defines alexipharmics, alexiterics, and other ancient antidotal preparations, as well as alkahest and *aurum potabile,* for which the search was still being carried on.

Lemery's definition of alcohol was given primarily as "a finely divided substance," which was the ancient Arabic meaning still perpetuated in our "Alcoholized Iron"; the definition of secondary importance was *spiritus vini rectificatus.* There was no definition of tinctures in the 1720 edition of Lemery's work, although tinctures had begun to come into use at that time and became an important class of preparations by the end of the eighteenth century. Barchusen's work, earlier referred to, but which appeared shortly after Lemery's, has the same

definitions of alcohol, but includes a definition of tinctures as well.

The list of important pharmacopœias and works of reference issued during the eighteenth century is a formidable one, and included the following titles arranged chronologically, as in the preceding chapter:

1701 *Pharmacopœia Extemporanea,* London.
1702 *Pharmacopoée de Bruxelles.*
1705 *Pharmacopœia Suecica.*
1713 *Dispensatorium Borusso-Brandenburgiæ.*
1716 *Dispensatorium Hamburgense.*
1718 *Pharmacopœia Londinensis* (the earliest revision of this work to appear in the eighteenth century).
1721 *Lexicon Pharmaceuticum* (Hellweg).
1722 *Pharmacopœia Edinburghensis* (the first appearance of this standard work).
1725 *Pharmacopœia Argentoratensis* (Strasburg).
1726 *Pharmacopœia Ratisbonensis.*
1729 *Pharmacopœia Oesterreichensis.*
1738 *Pharmacopœia Langana* (the Hague).
1739 *Pharmacopœia Madritensis.*
1739 *Dispensatorium Medico-Pharmaceutica Pragense.*
1741 *Pharmacopœia Leodiensis* (Liege).
1747 *Pharmacopœia Universale,* James.
1748 *Codex Medicamentarius, seu Pharmacopœia Parisensis.*
1750 *Pharmacopœia Wirtenbergica.*
1751 *Pharmacopœia Leidensis.*
1754 *New Dispensatory,* William Lewis.
1762 *Baumé's Elements of Pharmacy.*

1764 *Dispensatorium Pharmaceuticum Universale,* Daniel Triller.
1766 *French Military Formulary,* Richard Hautesierck.
1767 *Calendario Pharmaceutico,* J. J. Waldbaum.
1770 *Pharmacopoliologia,* A. K. Ernsting.
1771 *Pharmacopœia Helvetica.*
1772 *Pharmacopœia Danica.*
1777 *Dispensatorium Brunsvicense.*
1778 *Pharmacopœia Rossica.*
1780 *Pharmacopœia Genevensis.*
1782 *Pharmapologia Chirurgicalis, Viennensis.*
1782 *Pharmacopœia Rationalis,* Jacob Piderit.
1782 *Dispensatorium Brandenburgicum.*
1783 *Pharmacopœia Generalis, Argentorati.*
1786 *Dispensatorium Fulda.*
1786 *Dispensatorium Universale,* Chr. Fr. Reuss.
1788 *Pharmacopœia Londinensis* (the second revision during this century).
1788 *Manuel du Pharmacien,* Jacques Demachy.
1790 *Pharmacopœia Venetiæ.*
1792 *Pharmacopœia Amstelodamensis* (Amsterdam).
1796 *Pharmacopœia Herbipolitana* (Wurzburg).
1798 *Pharmacopœia Hispanica.*
1799 *Pharmacopœia Borussica.*

One of the works not enumerated in the foregoing list was a dispensatory of the several London hospitals—St. Thomas's, Gray's, and St. Bartholomew's, which appeared in 1741. A casual survey of this will reveal much that is illuminating regarding the materia medica of that day, for it is to be presumed that these hos-

pitals drew their medical attendants from the best of London's medical practitioners. Vipers' flesh was used in one of the preparations, and wood lice in several. Dried horses' hoofs was recommended for spitting of blood. Opium was known under the title *Extractum Thebaicum,* and was used in the majority of the formulas. Calomel was given in ten grain doses and jalap in thirty grain doses. The introduction to this work would seem to us of today to be anything but suitable for such a book. On one page is an illustration with the verse:

> " In the midst of life, Death doth us pursue.
> Let each, therefore, with speed for mercy sue."

The motto of the book was:

> " Prepare to die for behold Death and Judgment is at hand."

Quite a pleasant book to have fall into the hand of a prospective patient.

What a welter of confusion in formulas the foregoing list of pharmacopœias, etc. represents, for an examination of only a few of the books shows no attempt whatever at international or even national uniformity. Kipling must have been browsing over some of these old works when he wrote in " Our Fathers of Old ":

> " We are afflicted by what we can prove,
> We are distracted by what we know."

Baumé's *Elements of Pharmacy* was probably the most valuable book of the entire century, for the author was in emphatic opposition to the polypharmacy of contemporary physicians and pharmacists. This book, as mentioned before, went through seven editions. In its general arrangement it resembles the modern text books of pharmacy in that extemporaneous operations and those involving greater ability and knowledge are grouped in the latter part of the book under the heading "Magistral Pharmacy."

We must admit that the eighteenth century was a great century for pharmacy, and that pharmaceutists, as they were then usually called, played a very important part also in the development of chemistry, which was beginning to emerge as a definite science with a worthy objective very different from that in sight at the close of the previous century.

Fig. 49. Illustration of a famous eighteenth century pharmacy at Klattau, Germany. From Peters' Pictorial History of Ancient Pharmacy and Medicine. See page 357.

CHAPTER X

THE RECENT NINETEENTH CENTURY. THE DEVELOPMENT OF PHARMACY IN AMERICA

THE history of nineteenth century pharmacy is more difficult to write than that of any other period that has been considered. One reason is that we are closer to it and the task of selecting the salient features is increased in direct proportion to the wealth of material available. In the discussion of the progress of the nineteenth century it will be impossible to more than briefly refer to developments in chemistry and the allied sciences, and even in the history of pharmacy itself the student or interested reader will have to consult the literature of pharmacy for additional details.

Chemistry was but a branch of natural philosophy at the beginning of the century we are now considering, in which a well educated individual could compass all that had been achieved, as will be appreciated from the quotation of Priestley given in the previous chapter. At the close of the same century it had become a highly specialized science, in which pharmaceutical chem-

istry was only one of the subdivisions, and that itself has been specialized.

The history of pharmacy in the nineteenth century merits a special volume by itself, but an attempt will be made to cover the most important features in a single chapter.

Conditions in European, and also in American, pharmacy at the beginning of the nineteenth century are best illustrated by quotations from an address delivered to the members of the graduating class of the Philadelphia College of Pharmacy in 1829 by the President of that institution, Daniel B. Smith, who later attained distinction by being made the first President of the American Pharmaceutical Association in 1852:

> A lively French writer gives the following sketch of the condition of the apothecary at Vienna, which may be taken as a fair specimen of his situation throughout the large cities of Germany. The number of pharmaceutists in Vienna is limited, and in their shops the manual labor is distributed, so that one pupil makes all the pills, another all the mixtures, and this alternately for a month or quarter. The prescriptions are copied in a book to which the physician or the patient may at all times refer. The German apothecaries never contend with each other by underselling. They enjoy a consideration founded upon that which they pay to each other; their establishments are a fixed property, and there is neither rivalry nor collusion among them. Secure of realizing a fortune by their business, they introduce a rigorous method into all its

details. Less splendid in the exterior of their shops than the French, they have more true solidity in the arrangements within, and their medicines are recommended by the excellence of their preparation.

The German apothecaries have prevented their business from becoming purely mercantile. They have commanded respect from others by paying it themselves to their profession. In the midst of wars and disorders the German apothecaries have profited by the discoveries and improvements of other nations, and have remodelled their dispensatories upon the most scientific principles. More copious than the English, and less prolix and complicated than the French, their pharmacy has adopted the best parts of the Pharmacopœias of London and Paris, and is intermediate between these two systems. The Germans accordingly furnish apothecaries to many of the neighboring countries. They enjoy the monopoly of the business in Prussia, and there are none but German apothecaries in Moscow and St. Petersburg.

In the latter city an apothecary dare not make up a prescription of any practitioner whose name is not in the printed lists of physicians; nor can he venture to sell a drug, however small in quantity or insignificant in quality, without a prescription regularly signed; and everything sent from his shop must be wrapped in a sealed packet.

The practice of pharmacy in England has remained unfettered by any other legal restraints than those which restrict other branches of industry in that kingdom. The physician originally prepared and furnished the medicines for his own patients, but by degrees those who prepared the medicines became a separate class of men. The apothecary in England was at that time precisely what he is in America at this day—a retailer and compounder of drugs. The

temptation to prescribe for his customers appears to have been too strong to be resisted, and the apothecary lapsed by degrees into the practicing physician. The regularly educated resisted this innovation as long as it was in their power, and the controversy on the subject was both virulent and ludicrous. The apothecary, however, triumphed, although he rendered homage to the physician as his superior. He became the ordinary practitioner in families, charging not for his advice but for his attendance and medicines, and yielding his post to the physician in cases of emergency. The alliance is more profitable to the craft than to the patient, for it has given rise to such immoderate use of medicines among the English as has become proverbial, and justifies in degree the sarcasm of a French writer, who says that they carry their idolatry to medicines to such a pitch that they bear about them wherever they go their favorite salts and digestives.

In London, and all the cities and towns of Great Britain, apothecaries, or as they there style themselves, druggists, are now to be found who confine themselves to selling medicines, and who do not prescribe. Within the last forty years this class of tradesmen has greatly increased, and the principal shops of the kind in London are perhaps among the best regulated in the world. In one especially —the most celebrated in that great emporium—the system of businss is so perfect as to excite admiration. The shop is situated in a narrow court, the only access to which is through an arched alley. Before any article is allowed to be sold it is examined and approved, and if a chemical preparation, is tested by one of the partners, and no medicine is permitted to pass out of the shop but of the finest quality. Each clerk has his particular station at the counter, and the requisites of business about him, his money drawer

and medicine bottles, scales, measures and papers, for the utmost cleanliness of all which he is accountable. He sets down all the money he receives, as it is paid in, and keeps his own cash account. No conversation above a whisper is allowed except on business.

A minute account is kept, and an investigation is made at regular periods by one of the proprietors, into all the incidents of the shop, the errors in putting up medicines, or in the cash accounts, and of the manner in which the rules of the shop, which embrace all the minutiæ of cleanliness and method, have been observed. Such strict system and accuracy may be difficult to enforce, and may seem like an useless waste of time. But there is no such thing as too much system or accuracy in the business of an apothecary; and the great reputation of the shop to which I allude is a proof that it is profitable as well as creditable. A thousand guineas, it is said, have been offered to the proprietors as a fee for an apprentice.

Many wholesome regulations were enacted under the Bourbons about the middle of the last century; but the laws which created and now govern the schools of pharmacy were the offspring of the Revolution. The number of physicians who were members of the national assembly will account perhaps for the great attention which was paid by that body to the interests of the healing art; but it is nevertheless one of the extraordinary features of that period of violence and bloodshed, that neither its foreign nor civil wars, desperate and ferocious as they were, interrupted to any extent the progress of science and the arts.

The French law regulating the sale and dispensation of medicines establishes three schools of pharmacy—one at Paris, another at Strasburg, and a third at Montpellier. Each of these schools is obliged to open at least four courses

of experimental lectures—one on botany, one on the natural history of medicines, and the other two on practical pharmacy and chemistry.

The pharmaceutists in those cities are compelled to enter at the school the name, age, and other circumstances of their apprentices, who are all obliged to attend the lectures. An apprenticeship of eight years is required before a person is allowed to open a shop, except he has attended three courses of lectures in one of the schools, when only an apprenticeship of six years is exacted. We may suppose that the course of instruction in these schools is both learned and extensive from the length of time it occupies, which is five months, and from the strict scrutiny which is exercised over the attendance of the pupils. A roll of their attendance is kept, and the professor at the end of the course delivers to each one who has attended a certificate thereof. An absence without a legitimate excuse from six lectures will deprive a pupil of this reward. A prize is annually delivered at the expiration of the course for the best essay on any of the sciences taught in the schools.

When a pupil wishes to become a licentiate, he is required to produce the certificates of the school where he has studied and of the pharmaceutists with whom he has served his time, as well as an attestation of his moral conduct, signed by two resident citizens and two authorized pharmaceutists. He must also produce a certified copy of the register of his birth, to prove that he has completed his twenty-fifth year. If the director and professors of the school are satisfied with these documents, they appoint a day for the first examination. The student must undergo three public examinations, the interval between each of which must be at least a month. One of these is on the principles of the art; another on botany and the natural

history of the materia medica; the third examination is on the practice of pharmacy, and continues for four days. It consists of at least nine chemical or pharmaceutical processes, performed by the candidate in the presence of the examiners, to whom he must describe the materials, the operation and the results, and explain the rationale of the process. He must receive the votes of two-thirds of the examiners before obtaining his diploma. In those places where there is no school of pharmacy established, the examinations are conducted in the same manner by a jury composed of physicians and pharmaceutists, and no person is allowed to practice unless licensed by a jury, or by one of the established schools. The licentiates of the schools can exercise their profession in all parts of the kingdom; those of the juries are restricted to the department in which they have been examined. No pharmaceutist is permitted to sell any secret medicine. At Paris, Strasburg, and Montpellier an annual inspection of the shops and warehouses of the pharmaceutists and druggists is performed by a Board consisting of two professors in the medical school, the members of the school of pharmacy and a commissary of the police. All deteriorated or badly prepared drugs are seized by the commissary, and the person in whose shop they are found is liable to a fine of one hundred livres and an imprisonment not exceeding six months. These annual visits of inspection are paid in other places by the juries who examine the candidates.

The laws regulating the sale of poisons are exceedingly severe, and the list of forbidden medicines extends considerably beyond the usual limits of caution in this country. It includes not only arsenic, corrosive sublimate, and lunar caustic, but the mineral acids, several preparations of zinc, antimony and copper, and caustic potash. All these sub-

stances are required to be kept in secure and separate apartments, of which the master of the shop alone keeps the key. They are to be sold to none but a known and resident person, under a penalty of three thousand francs; and all purchasers must write their names and residence, the quantity and nature of the poisonous drugs they have bought, and the purpose for which they are wanted, in a register open to the inspection of the police, under the same penalty.

There is another branch of the public law of France on this subject which deserves our particular attention, for it strikes at the root of a practice of great extent and great mischief in our own country; I allude to the encouragement given by our druggists to ignorant, idle, and drunken collectors of herbs and roots. No person is allowed to follow the business of an herborist, as it is there called, without undergoing an examination into his competency before the same bodies which examine the pharmaceutists. This examination extends to his knowledge of medicinal plants and of the precautions necessary to their collection and preservation. A certificate of examination is furnished to the successful candidate and he is subjected to the annual visits of inspectors in the same manner as the pharmaceutists.

Notwithstanding the wisdom of many of these regulations, it appears that in the enforcement of the law many abuses have crept in. The professors in the schools of pharmacy, in order to augment their fees, have been still more careless of the qualifications of candidates. The consequence has been that the country is overrun with ignorant and unqualified licentiates, who blend other branches of industry with the sale of medicines.

These abuses attracted the attention of the society of pharmaceutists of Paris, which addressed a memorial in the year 1817 to the Chamber of Deputies on this subject.

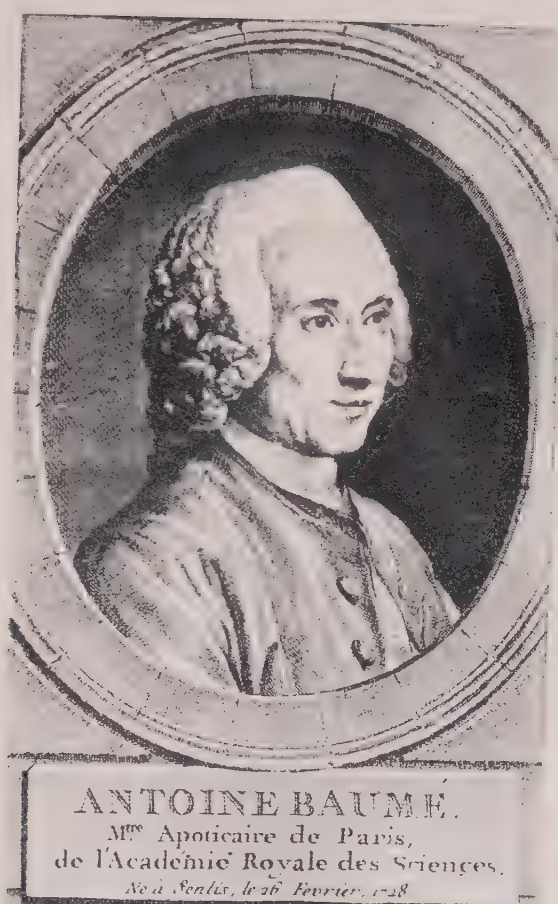


FIG. 50.—PICTURE OF ANTOINE BAUMÉ, CELEBRATED FRENCH PHARMACIST, FROM ONE OF HIS EIGHTEENTH CENTURY WORKS. SEE PAGE 365.

In this memoir they speak with becoming pride of the high character of their profession. "The knowledge," say they, "which pharmacy requires, without being as extensive, is in part the same as that which is necessary to the physician. It is as various, and is sufficiently useful to entitle him who possesses it to the particular protection of government and to general respect. The pharmaceutists enroll in their number men of distinguished learning, who belong to the most celebrated academies, skilful professors who fill the chairs of chemistry and natural history, writers whose works are sought for in France and abroad, respectable citizens whose public services have been rewarded by honors, titles and decorations." It is only to enumerate the names of Parmentier, Vauquelin, Deyeux, Henri, Planche, Pelletier, Virey, Boullay, and Robiquet, to vindicate the warmth of this honest eulogium.

In speaking of the abuses which had crept in through the causes to which I have alluded, they observe that "the number of established pharmaceutists soon exceeded everywhere the wants of the inhabitants. This disproportion between the shops and the population was equally fatal to pharmacy and the public. When the confidence of physicians and patients is divided between too great a number of shops, does it not offer temptations to the least successful, which are at the least of great inconvenience to those who trust for their cure to the faithful execution of the prescriptions of the physician? Whatever may be the probity of a pharmaceutist, his pecuniary means, his credit and his sales always influence the proper choice, preservation and renewal of the medicines he employs. This profession bears no resemblance to those in which the prosperity of the trader is useful only to himself. The prosperity of the pharmaceutist is a guarantee to the public almost

equal to that which is afforded by his learning. This guarantee disappears if the multiplicity of shops places a part of them in a precarious situation."

"The medical juries," say they, "have peopled the country and the small towns with apothecaries destitute of all the requisite learning and science whose knowledge of their business was limited to a few manual operations."

"The want of discipline and inspection opens the door to many other abuses. Perfumers, confectioners, and distillers undertake to sell medicines; and to crown these disorders a crowd of charlatans, without title, without learning, and wihout shame, have established themselves in the towns and villages, cover the walls with their bills, and distribute them on the bridges, the wharves and public walls. These men are neither physicians, surgeons nor pharmaceutists; yet they practice physic, surgery and pharmacy; they inundate the country with their nostrums; and the public journals, which are hired for the purpose, daily make a boast of these pretended specifics."

Who does not recognize in this sketch of the condition of pharmacy in France many of the evils which mark in a far higher degree its state in our own country—the want of scientific skill and of competent qualifications—and the evils of unrestricted competition?

The pharmaceutic code of Prussia has provided against the abuses of which French pharmaceutists complain, by requiring and carrying into effect a far more rigorous examination of the candidates. The laws of that kingdom require that a candidate for examination must have served a regular apprenticeship for five years, or have been employed for three full years as an assistant in a licensed shop, and at the completion of either period, must have attended two full courses on botany, chemistry and natural

history, pharmacy and medical jurisprudence. The board of examiners is composed of two chemists and naturalists and two scientific and practical apothecaries, who are paid by the government, and have had no part in the instruction of the pupil. The candidate is first obliged to translate passages taken at random from the Prussian Pharmacopœia, to satisfy the board of his skill in the Latin language. He must then write a Latin theme on two subjects of chemistry or medical jurisprudence, the titles of which are drawn by lot from an urn.

This theme must be written in eight hours, in the presence of the examiners, without the aid of books, assistants, or extracts. If he pass this ordeal, two difficult subjects of pharmaceutic or analytic chemistry are given to him, upon which he is obliged to write a theme at his own dwelling, with the aid of books, in order to prove that he has received the highest scientific chemical education. He then draws by lot two chemical or pharmaceutic substances, either natural or artificial, and is allowed eight days, at the end of which time he must have made a complete analysis of them, and written down the results of his experiments. He is also obliged to analyze the contents of the purposely poisoned stomach of an animal, and to write a juridico-chemical paper thereon. Not satisfied with so close a scrutiny, which would deter any apothecary in this country from soliciting an examination, the candidate is then required to draw by lot the names of two pharmaceutic compounds of difficult preparation, which he is obliged to prepare in the presence of the committee extemporaneously.

Specimens, fresh and dry, of official plants, ten samples of drugs, and several chemical preparations are then placed before him, which he must name at sight. He must then give accurate scientific descriptions of the plants and

of their uses, must describe the origin, properties, and adulteration of the drugs, and the chemical elements, mode of preparation, and usual adulterations of the chemicals, and the means of testing their purity.

The examiners are obliged to be present through all these trials, and to keep accurate minutes of their proceedings, and of the success or failure of each attempt. If they approve of the candidate by a majority of votes he is admitted to the public examination, at which he must answer questions in chemistry, natural history and medical jurisprudence; after which, if he is still further approved of, he is recommended to the Minister of the Interior, who gives him a license to practice his art.

From this brief and imperfect sketch of the laws regulating the practice of pharmacy abroad, let us turn to the condition of the art in our own country. How great is the contrast! An entire absence of legislative enactments, and with the solitary exception of this city, an almost entire want of professional emulation and of scientific instruction. This state of things has arisen from the freedom of our institutions, which places no restraint whatever upon private enterprise, and from the recent settlement of the country, which still checks that subdivision of labor that is perhaps necessary to the highest degree of excellence in the arts and sciences.

It is but a few years compartively since the business of the apothecary was separated from that of the wholesale druggist and the dealer in paints and dyestuffs. Not thirty years ago almost the only apothecary's shop in Philadelphia, where the physician was sure of obtaining the latest foreign preparations, of having his medicines and prescriptions prepared under the eye of the master, and with competent pharmaceutic skill, or in which a strict system

of accountability was carried through the details of the shop, was that of the late Charles Marshall. The cause of his success in business was his strict integrity, his scrupulous accuracy, and his patient attention. As the first president of this College he is entitled to our respect and remembrance. He was one of its warm supporters, and though too far advanced in years to take an active part in its proceedings, the interest which he felt in its welfare continued to the close of his long and useful life.

It is now about ten years since an accidental circumstance first impressed the apothecaries and druggists of Philadelphia with the necessity of exercising some supervision over the sale of medicines. A case of opium was purchased in New York by one of our principal dealers, which was said to be Persian opium, and which was soon discovered to be a fraudulent preparation. A meeting of the trade was held and a committee appointed to investigate the history and nature of the opium, which they did, and published their report in the daily papers. The fraudulent drug was immediately withdrawn from the market, and no similar attempt of imposition has since come to the knowledge of the public. From that time the necessity of forming an association of druggists became a favorite subject of discussion with many in the trade.

In the year 1821 the trustees of the University of Pennsylvania, at the suggestion principally of the professor of materia medica, made provision for conferring the degree of Master of Pharmacy on those apothecaries who should be deemed most competent to the business, and for the establishment of lectures on pharmacy, the examination of candidates, and the admission of them to practice under the sanction of the medical school of the University

This arrangement was defective in many respects; it

would have created a control over the business of the apothecary without any equivalent compensation, such as our College has rendered. The druggists, therefore, resolved to take into their own hands that supervision and improvement of their trade which was acknowledged on all hands to be expedient. A meeting was held on the thirteenth of February, 1821, at which the principal druggists attended, when it was resolved to form a college of apothecaries for the purpose of regularly instructing apprentices in the scientific parts of the business and of checking the prevalent abuses. The College was incorporated in the year 1822, by the title of the Philadelphia College of Pharmacy, and its career from that day to the present has been one of steady and active exertion for the improvement of our business.

The extent of these exertions and of the advantages which have flowed from them are not now appreciated, for they consist in great measure in clearing the ground and laying the foundation for future labors. The first efforts of the College were directed to the formation of a school of pharmacy. The regulations which it has adopted in relation to this, are perhaps all that the present state of our business will admit. The members are restricted from taking apprentices for a shorter period than four years, and each apprentice is required to take two full courses of lectures, one on materia medica and pharmacy, and the other on chemistry. At the expiration of his apprenticeship he may, provided these conditions have been fulfilled, become a candidate for the diploma of the College, and must submit to an examination before a committee, consisting of the professors and three members appointed by the College.

Our diploma is, of course, but an honorary distinction, that confers no privileges or advantages beyond those which

public opinion accords to the well instructed and intelligent. It bestows no title, for it was the design of the College to avoid any name which may hereafter acquire a peculiar meaning, and become the designation of a new class analogous to the English apothecary. In attempting to avoid this danger, it has committed what may perhaps be esteemed a blunder, by establishing a distinction without giving to it a specific name, and simply declaring that the successful candidate is a graduate in the College. Those who have already passed their examination may be disposed to smile at the contrast between the trial to which they have been subjected and the severe ordeal of the Prussian code. It is true that we require as yet no proof of skill in analytic chemistry, but the questions of the examiners extend to all the branches of chemistry, pharmacy, and natural history which are taught in the lectures as well as to the more practical details of the business of an apothecary.

To answer these questions with the promptness and accuracy that have in most cases been done, implies an acquaintance with the theory and practice of our art highly creditable to the candidates, and when contrasted with the state of things but a few years past, full of promise for the future. A taste for chemical pursuits has been awakened in our apprentices, who have formed themsleves into a chemical society, which meets in this hall under the auspices, we may say, of the College. We already perceive the beneficial effects of thus arousing their ambition in their increased attention to our interests and their love of the business, and I speak from experience when I say that the direct and immediate influence of the school of pharmacy has been to enhance to the master the value of his apprentice. This happy result is no doubt owing in

great measure to the personal character and influence of the professors whom it has been the good fortune of the College to secure.

In this masterly review of the situation the author has also included a brief history of the origin of the Philadelphia College of Pharmacy, now the Philadelphia College of Pharmacy and Science, the first college of pharmacy to be established in the New World. Any one wishing to pursue this phase of the subject further should read *The First Century of the Philadelphia College of Pharmacy and Science,* issued in 1921 under the able editorship of Joseph W. England, now chairman of the Board of Trustees of the institution.

The nineteenth century was ushered in by a number of interesting happenings among which were the development of the new methods of locomotion by railway and steamship which distinguished this century throughout its entire period. Shortly prior to the opening of the century, in 1799, the Royal Institution of Great Britain was founded. This Institution was to have a profound effect upon the development of science in general and of chemistry in particular, for it was here that Davy, Faraday, and others made their discoveries. The Institution was founded by an American, Benjamin Thompson,

who went abroad and attained distinction in Bavaria, and subsequently, under the title of Count Rumford (the title granted by the Pope as a Count of the Holy Roman Empire), he settled in England after marrying the widow of the ill-fated Lavoisier.

It is not generally known that the title "Rumford" was taken from the original name of the town of Concord, New Hampshire, where Thompson considered his good fortune to have begun. It was Count Rumford who first emphatically stated, and further demonstrated by experiment, that heat was a form of energy, and his work had a great influence in overthrowing the phlogiston theory.

It is a curious complimentary coincidence that the Smithsonian Institution of the United States, founded about the middle of the nineteenth century, was started by an English chemist and mineralogist Robert Smithson.

In 1801, shortly before the death of Priestley, Robert Hare, Philadelphia's most eminent early chemist, invented the oxyhydrogen blowpipe, and Priestley's discovery had its first practical and industrial application.

In 1804 the first steam locomotive appeared in Wales and in 1807 Fulton and Fitch developed

the steamboat in America. The first steamship crossed the Atlantic in 1819.

The noteworthy researches of three European apothecaries, Derosne, Seguin, and Sertürner, in the first decade of the nineteenth century led to the discovery of the first alkaloid, morphine, which was announced in 1815 by Sertürner after several preliminary papers upon the subject had appeared. This discovery stimulated research upon many vegetable drugs by a number of investigators, and in rapid succession came the announcement of the discoveries of quinine, strychnine, brucine, narceine, and veratrine by Pelletier and Caventou, of emetine by Pelletier and Magendie of solanine by Desfosses, of nicotine by Vauquelin, of atropine by Brandes, of delphinine by Feneulle and Lassaigne, of codeine by Robiquet, and of picrotoxin by Boullay.

Every one of these discoveries was made by a pharmacist. Derosne was a French pharmacist who turned his attention to manufacturing chemistry. In 1803 he thought he had discovered the active principle of opium, but it turned out later to be narcotine which he had isolated, and which for a time was called Derosne's salt. Narcotine was misnamed, as it possesses no narcotic properties. Seguin had been an assistant to Fourcroy. He worked upon a process in 1804 for making

the active principle of opium, but his paper was not published until 1814 and he did not realize its importance. Seguin had made a serious error in one of his researches upon cinchona. He announced the active principle of that drug to be gelatin, being misled by the fact that the alkaloids and gelatin are both precipitated by a solution of tannin. While Derosne and Seguin had been making these investigations, a German apothecary of Eimbeck, Friedrich Wilhelm Adam Sertürner, had been plodding along in his little laboratory. He published a paper in 1806 announcing the discovery of a new organic acid in opium, which he later called meconic acid, and in 1815 he published a final paper announcing the discovery of the narcotic principle of opium, which he named *morphium,* from Morpheus, the god of dreams, who in mythology was the servant of Somnos, the god of sleep.

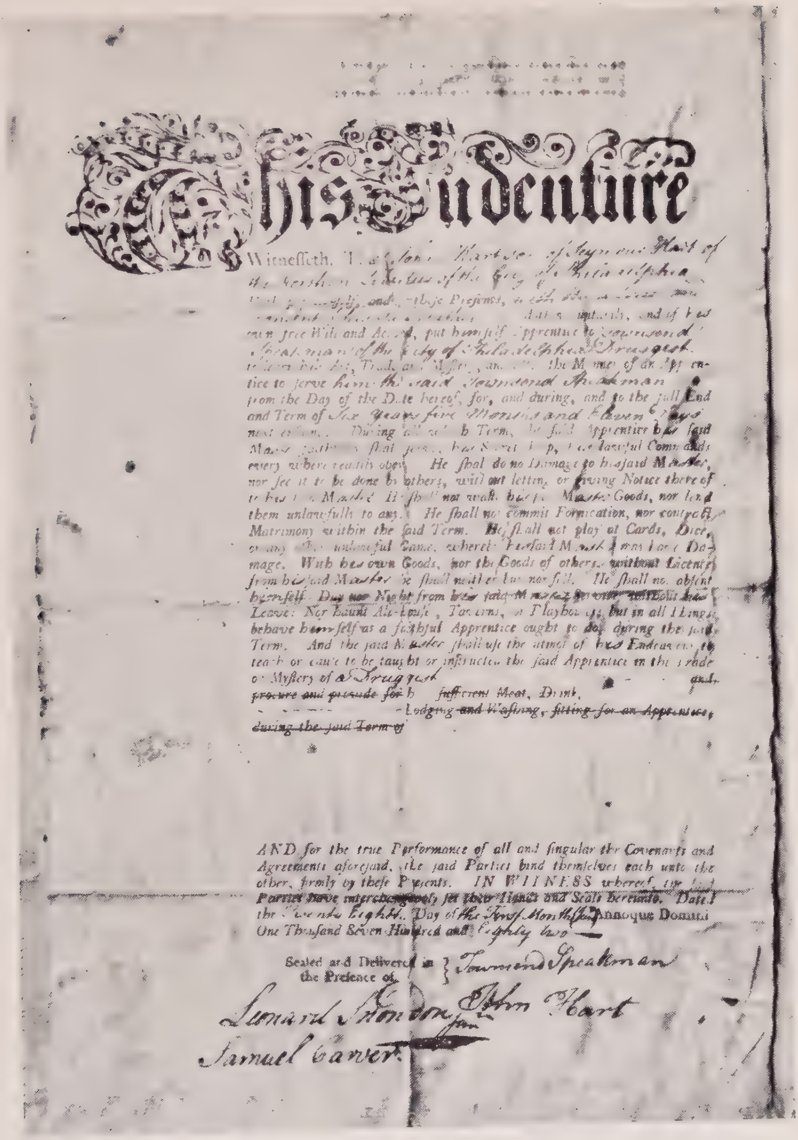
Joseph Bienaime Caventou was a retail pharmacist in Paris. He was not as brilliant as his associate Pelletier, with whom he worked for many years, and he made few independent discoveries, while his co-worker made many.

Joseph Pelletier was a pharmacist and the son of a Paris pharmacist. He was probably the most gifted worker scientific pharmacy has ever known, except Scheele. With his co-worker

Caventou he unraveled the mystery of many plant principles which are in common use today. Pelletier and Caventou were awarded a prize of 10,000 francs by the Paris Institute of Science, for the discovery of quinine. This was their only reward for these generous contributors to science took out no patents on their discoveries, as they might easily have done.

How different is the practice of the majority of inventors and discoverers of new remedies of the present, whose first object is to claim priority and to file patent specifications covering not only their own processes, but a large number of other processes which were not actually, but might have been, used; to give the article a distinctive proprietary name in which they have what practically amounts to perpetual rights, and then spend their best energies and their valuable time in protecting or defending these claims. The inventor or discoverer of a new substance which benefits humanity by preventing, curing, or alleviating human ills is certainly entitled to a reward, but under our cumbersome and archaic patent laws the profits frequently go to the wrong individual, or the reward is out of proportion to the real value of the discovery.

An ideal way of handling the question of



This Indenture

Witnesseth, That John Hart [illegible] Hart of the [illegible] of the City of Philadelphia [illegible] and these Presents, [illegible] and of his own free Will and Accord, put himself Apprentice to Townsend Speakman of the City of Philadelphia Druggist [illegible] Trade, [illegible] the Manner of an Apprentice to serve him the said Townsend Speakman from the Day of the Date hereof, for, and during, and to the full End and Term of Six Years five Months and Eleven Days next ensuing. During all which Term, the said Apprentice his said Master faithfully shall serve, his Secrets keep, his lawful Commands every where readily obey. He shall do no Damage to his said Master, nor see it to be done by others, without letting or giving Notice thereof to his said Master. He shall not waste his said Master's Goods, nor lend them unlawfully to any. He shall not commit Fornication, nor contract Matrimony within the said Term. He shall not play at Cards, Dice, or any other unlawful Game, whereby his said Master may have Damage. With his own Goods, nor the Goods of others, without Licence from his said Master he shall neither buy nor sell. He shall not absent himself Day nor Night from his said Master's Service without his Leave: Nor haunt Ale-houses, Taverns, or Playhouses; but in all Things behave himself as a faithful Apprentice ought to do, during the said Term. And the said Master shall use the utmost of his Endeavours to teach or cause to be taught or instructed the said Apprentice in the Trade or Mystery of a Druggist [illegible] and ~~procure and provide for~~ h[illegible] sufficient Meat, Drink, [illegible] Lodging ~~and Washing, fitting for an Apprentice, during the said Term of~~

AND for the true Performance of all and singular the Covenants and Agreements aforesaid, the said Parties bind themselves each unto the other, firmly by these Presents. IN WITNESS whereof, the said Parties have interchangeably set their Hands and Seals hereunto. Dated the Twenty Eighth Day of the First Month (Jan) Annoque Domini One Thousand Seven Hundred and Eighty two —

Sealed and Delivered in the Presence of } Townsend Speakman

Leonard Snowdon jun. John Hart

Samuel Carver

FIG. 51.—LATE EIGHTEENTH CENTURY INDENTURE IN PHARMACY IN THE POSSESSION OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE. SEE PAGE 399.

patents and royalties has been worked out in connection with the manufacture of *insulin.*

Francis Magendie was not a pharmacist but was a medical graduate who was well trained in chemistry and who may be said to have been the pioneer in experimental physiology. He established the first journal devoted exclusively to physiology, the *Journal de Physiologie Experimentale,* and he was the author of a *Formulary,* through the medium of which a number of the alkaloids and other then recently discovered chemical substances were introduced into medicine and pharmacy. The title page of an American edition of this interesting work is shown in illustration No. 57, opposite page 510.

Magendie worked upon emetine in conjunction with Pelletier.

Rudolph Brandes was the son of a German apothecary of Salzuffeln, who followed in his father's footsteps for some years, and finally became the leading authority of his country on plant chemistry. He was an author and editor of numerous chemical and pharmaceutical publications.

Jean Louis Lassaigne was a noted apothecary of his time who later became professor of chemistry in the University of Paris. He made a number of valuable discoveries in plant chemistry,

partly alone and partly in collaboration with Feneuille, of whom little is known.

There were two Boullays, who for the most part worked conjointly. They were Pierre François Guillaume Boullay, the father, and Polydore Boullay, the son. The father discovered picrotoxin and the son worked with Jean Baptiste Dumas, one of the most famous chemists of France. The Boullays were pioneer workers on the subject of percolation, which was then called displacement. The son lost his life in 1835 from injuries following an explosion of ether with which he was working.

The attention of the Boullays had been directed toward percolation by the work that had been previously done upon this subject by Pierre Jean Robiquet, who was at first a pupil of Fourcroy and later of Vauquelin. He was the discoverer of codeine and the first to explain the reactions involved in the production of the volatile oils of bitter almond and of mustard.

Louis Jacques Thenard was so anxious to study pharmacy that he implored Vauquelin to allow him to work without pay, and happened to get the opportunity only because Vauquelin's sister needed a kitchen boy at the time, which position he gladly accepted temporarily. He discovered hydrogen peroxide, became one of

France's most eminent pharmacists and was made a peer in 1832.

Bernard Courtois discovered iodine in 1811. He was a native of Dijon and studied pharmacy first under a local preceptor and later under Fourcroy, Seguin, and Thenard. He had been making artificial saltpetre and was experimenting with the ashes of seaweeds (kelp) to extract the sodium carbonate. In the mother liquor of one of these experiments he noticed that upon the addition of sulphuric acid violet vapors appeared, which upon condensation yielded crystalline plates with a metallic lustre. He was too busy with other matters to pay much attention to it, but he told another chemist, a friend named Clement, about it, and Clement presented a report on the substance to the Paris Academy of Sciences in 1813. Neither Courtois nor Clement suspected the elemental nature of this substance, but the eminent English chemist, Sir Humphrey Davy, who happened to be in Paris at the time Clement's paper was presented, saw the possibility of this being the case and immediately started experimental work upon it. He confirmed his suspicions and sent his opinions concerning the subject to his friend Cuvier in a private letter. In the meantime, Gay-Lussac had also been working on the same subject and

announced his opinion of the elemental character of the substance in a paper presented to the Paris Academy in December, 1813.

Davy and Gay-Lussac thereupon entered into a wordy battle as regards the priority of the discovery, poor Courtois being entirely forgotten for the time. The name which Davy gave to the element, *iodine,* still applies. It is derived from the Greek word *ion,* meaning violet, which in turn is derived from an older word, *fioñ,* from which the name of the flower (Latin, *viola*) is derived.

Bromine, a companion element to iodine, was also discovered by a French pharmacist, Antoine Jerome Balard. Balard was a native of Montpellier, and after qualifying as a pharmacist established himself in business in that city. Being of a scientific and investigating turn of mind he spent his spare time in research. Working with the salts extracted from a neighboring salt marsh, he was surprised by certain unexpected reactions, and continuing his investigations he discovered bromine, the connecting link between the halogen elements chlorine and iodine.

Bromine derives its name from the Greek word *bromos,* meaning a stench, from the disagreeable odor of the vapor when very much diluted with air. This discovery won him the

medal of the Royal Society of London and a professorship of chemistry in his native city, Montpellier, from whence he later went to Paris to occupy prominent positions in his profession. The name bromine was conferred upon the element by Gay-Lussac, Balard having named it *muride,* from *muria,* brine.

It is said that nearly pure bromine had actually been obtained as a by-product by some salt manufacturers in Germany some years before Balard's discovery. A specimen of the material had been sent to Liebig, who carelessly put it aside under the impression that it was iodine chloride, which it somewhat resembles in its physical appearance. When Liebig heard of Balard's discovery he looked up the specimen and realized that he had missed an opportunity of announcing a new element. It is said that Liebig afterward kept this specimen for years with others in a special cupboard, labeled "Cupboard of mistakes."

Balard spent many years perfecting a method of separating potassium compounds from the waters of salt marshes, and after he had finally succeeded, the discovery of the native potassium salt deposits at Stassfurt, Germany, dashed to the ground his hopes of commercial benefit.

We must go back to the beginning of the

nineteeenth century for a brief period to discuss one of the greatest of chemists, John Dalton, whose atomic theory made possible the progress of chemistry as a science.

The philosophical speculators regarding the constitution of matter as composed of minute distinctive particles had never been formulated into a workable theory until Dalton in 1804 published his views on the composition of matter. These views gained widespread circulation by being incorporated in the third edition of a text book by Thomas Thomson, called *A System of Chemistry*. Dalton's original theory contained some erroneous assumptions concerning the shapes and relative weights of the elements, which he at first called "simple bodies." He assigned arbitrary symbols to the more important of these simples bodies, which were soon discarded in favor of the symbols now in use.

By 1808 he had elaborated his theory and made it more precise, and it was published in his book called *A New System of Chemical Philosophy*. In this book he uses the word "atom" as we now use it and he explained the formation of binary, ternary and other simple compounds on a mathematical basis. Dalton's views were accepted by some of his contemporaries and rejected by others. Sir Humphrey Davy was one

FIG. 52.—SYMBOLIC PAINTING, SHOWING CHRIST AS AN APOTHECARY. FROM THE *Pharmaceutical Review*. SEE PAGE 358.

of his most noted opponents for years, and Davy's own reputation for fairness and astuteness suffered great injury when he ridiculed and even caricatured Dalton's theory before some of the learned societies when it came up for discussion.

Although Dalton's theory had been published in 1804 and again in 1808, it was not until 1822 that he was honored by election to membership in the Royal Society, although he had been elected to the French Academy some years earlier. The ultimate acceptance of Dalton's theory was hastened by the work of Amedeo Avogadro, an Italian scientist, who enunciated the law of multiple proportions and first used the word molecule in its present significance in an essay published in 1811.

In 1826 Dalton was awarded the first of the Royal Society medals, given by the King, and by this time, Sir Humphrey Davy, as President of the Royal Society, was so thoroughly converted to Dalton's views that in presenting the medal on behalf of the organization, he compared Dalton's work in chemistry to that of Kepler in astronomy. Dalton was one of the most outstanding examples of an individual accomplishing great work in spite of being handicapped by deficiencies resulting from an imperfect education, for he never had any formal schooling, having supported himself

from the early age of twelve when he commenced teaching in the village school.

Joseph Louis Gay-Lussac was a contemporary of Dalton. He was a pupil of Berthollet in the *Ecole Polytechnique,* from which he was graduated in 1800. His first scientific work was on the subject of meteorology. In pursuance of this work he made balloon ascensions, crossed the Alps, and ascended Vesuvius upon six different occasions. He was a member of that select group of scientists organized by Berthollet under the name *Société d'Arcueil* which held its meetings at Berthollet's country residence.

Gay-Lussac's most notable work was done in connection with the combining volumes of gases, and was published in the memoirs of the Society just mentioned, in 1808.

Sir Humphrey Davy obtained his earliest scientific training in the apothecary shop of Mr. Borlase at Penzance. He was a precocious youth who planned his studies along ten distinct lines, at the age of seventeen. A notebook of his, compiled in 1795 (he was born in 1778), shows among the subjects of his reading and study the following: Theology, geography, language, logic, physics, mechanics, rhetoric, history, and mathematics, and under the heading " My profession " were included pharmacy, botany, anatomy, and

chemistry. He was a litterateur, a poet, a philosopher, a sportsman, and a man of the world.

Count Rumford gave Davy his first real opportunity at the Royal Philosophical Institution and in 1801 Davy delivered his initial lecture in that noted building, on the subject of galvanism. Davy was so thorough and painstaking in his work that he almost invariably rehearsed his lectures before his assistants the day before their delivery.

Davy's lectures at the Royal Institution covered not only the field of pure chemistry for the benefit of the leaders of the scientific world, but they included a number of lectures on chemistry as applied to the arts and manufactures, which were planned along the lines of the popular science lectures of today. His greatest discoveries were in connection with the isolation and identification of the alkali metals, potassium and sodium, and the metals of the alkaline earths calcium, magnesium, etc. He also proved the elemental character of chlorine which had been called " dephlogisticated muriatic acid " from the time of its discovery by Scheele. His work upon the chemistry of flame and the invention of the miners' " safety lamp," which still bears his name, were of great economical and practical importance.

Davy was the recipient of many honors both at home and abroad. He died in Geneva in 1829 at the early age of fifty-one. Before his death, however, Davy had provided a worthy successor at the Royal Institution in the person of Michael Faraday, a journeyman bookbinder, who became interested in science through binding a number of books upon chemical and electrical subjects. In 1812 he listened to a few of the popular lectures of Sir Humphrey Davy, and having made copious notes of them, which were illustrated with pencil drawings, he sent them to Sir Humphrey with a note expressing a desire for an interview. The outcome of this was his engagement as an assistant in the laboratory of the Royal Institution at a salary of twenty-five shillings a week and two rooms in the attic.

In this same year Faraday became Davy's secretary and traveling scientific assistant. It was while traveling in Europe in 1814, in the above capacity, that he witnessed the classic experiment of burning a diamond in oxygen by means of heat produced by a lens focussing the sun's rays, thus proving its elemental character as crystalline carbon, for the product of combustion, upon analysis, was found to consist entirely of carbon dioxide.

Faraday's lectures were always of a very bril-

liant character, very different from the dry (even though painstaking and thorough) presentations of his predecessor, Sir Humphrey Davy. In consequence of this, Davy, a few years before his death, became very jealous of Faraday and tried to prevent his election as a Fellow of the Royal Society in 1824, but did not succeed.

In 1825 Faraday became Director of the Laboratory of the Royal Institution and he began his individual researches which were to have such a profound effect upon the development of physics, for while he made some brilliant discoveries in chemistry, his epoch-making work was all done in the field of electricity. In this field he originated the words *ion, electrode, anode,* and *cathode.* His work upon electricity paved the way to the invention of the dynamo.

He was modest in his tastes and spurned many opportunities to capitalize his knowledge by patenting his inventions. His sole income was that derived from the Royal Institution, about £200 a year, plus a small pension allowed him by the English government in 1835.

Faraday introduced the custom of lecturing to juvenile audiences and his *Chemical History of a Candle* is a classic example of scientific facts explained in simple, understandable language. The author has a copy of this book in which some

former owner has pasted an autograph letter of Faraday's. It is addressed to Dr. B. Sieman, and is dated November 19, 1864, three years before his death. The letter was evidently a reply to a request for a subscription to some cause and reads as follows:

Sir:

I am too poor to subscribe to the fund referred to within. I cannot afford to meet all the demands that are properly made upon me.

I am,
Your obd't servant,
M. Faraday.

He died in 1867 after having relinquished his duties at the Royal Institution several years previously. Faraday was a lonely and a peculiar soul, refusing all honors, even the Chairmanship of the Royal Institution and the Presidency of the Royal Society, both of which positions were offered to him. He had no collaborators and no disciples to carry on his work and his ideals.

While Davy and Faraday were making history in the laboratories and lecture halls of the Royal Society, Keats, the youthful apothecary's apprentice in the shop of Mr. Hammond, at Edmonton, was familiarizing himself with drugs and their properties, awaiting the time when the accidental reading of the "Faerie Queene" was

to transform him to one of England's greatest and best-loved poets.

In *Endymion* he speaks of " bay leaves and gummy frankincense," of " manna picked from Syrian trees," of " fennel green and balm." In the *Eve of St. Agnes* he speaks of " candied apples, quince, and plum and gourd

" With jellies soother than the creamy curd,
And lucent sirops, tinct with cinnamon;
Manna and dates, in Argosy transferred
From Fez, and spiced dainties, every one
From silken Samarkand to cedared Lebanon."

What has become of the critics who in *Blackwood's Magazine* of that day bade the young pharmacist " back to his gallipots " ?

One of the interesting characters of the early part of the nineteenth century, who was a pioneer in food chemistry, was Frederick Accum. He published an interesting work called *Chemical Amusements,* which contains directions for performing many striking experiments in elemental chemistry, but he is best known for his book entitled *A Treatise on Adulterations of Food and Culinary Poisons,* by Frederick Accum, " Operative Chemist, Lecturer on Practical Chemistry, Mineralogy and upon chemistry applied to the arts and manufactures; Member of the Royal Irish Academy; Fellow of the Linnæan Society;

Member of the Royal Academy of Sciences, and of the Royal Academy of Arts of Berlin, etc."

Still another of the same type was James Cutbush, who wrote several works on chemistry in the first decade of the nineteenth century. Cutbush was the last apothecary-general of the United States Army, and as professor of chemistry at the United States Army College at West Point became a pioneer in the chemistry of explosives.

We have neither the space nor the time to complete the consideration of the many others who contributed to the field of chemistry during the first half of the nineteenth century, nor can we even mention them all by name, for the history of chemistry is a subject that has already been covered by many authors in various ways.

Among the more notable of these, however, must be mentioned, Proust, Wollaston, Mitscherlich, Berzelius, Dulong, Petit, Chevreul, Fraunhofer, Dumas, Wöhler, Liebig, Bunsen, Draper, Berthelot, Doebereiner, Laurent, Pelouze, Gibbs, Cahours, and Kekule. A number of these had been originally trained in pharmacy. Liebig, who had himself been trained as an apothecary, pays the following tribute to pharmacy in one of his works; in 1859:

Only about seventy years ago was chemistry, like a grain of seed from a ripe fruit, separated from the other physical sciences. With Black, Cavendish, and Priestley its new era began. Medicine, pharmacy and the useful arts had prepared the soil upon which this seed was to germinate and flourish.

Wöhler's epoch making synthesis of urea from ammonium cyanate is said to have been anticipated two years previously by an English apothecary named Henry Hennel, who is said to have synthesised ethyl alcohol in 1826.

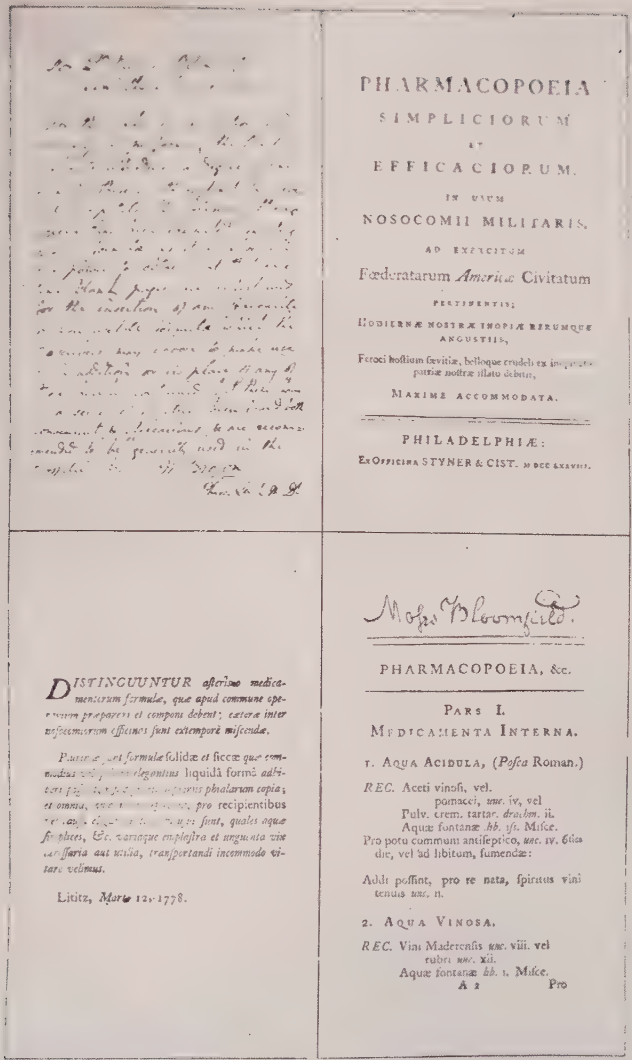
The manufacture of chemicals really began in America during the eighteenth century for such products as soap, candles, liquors, glass, pottery, bricks, gunpowder, indigo, leather, metals, naval stores (rosin, tar and turpentine), oils, paints, varnishes, paper, sugar, glue, lampblack, potash, and certain chemicals, as saltpetre, Glauber's salt, had been manufactured in this country prior to 1800. The Continental Congress had encouraged the establishment of powder mills and Congress in 1775 published a manual giving directions for making saltpetre.

Dyeing and weaving were important industries in Revolutionary days. Samuel Wetherill was one of the promoters and managers of the "United Company of Pennsylvania for the establishment of American manufactures," and

established one of the earliest dyeing companies in the country. He furnished fustian (a cloth consisting of a linen warp and a cotton woof, named for the Egyptian city where it was first made) for the Continental Army, as well as other supplies, and the timeliness of his aid is said to have saved Washington's army at Valley Forge from disbanding. This departure from the pacifist teachings of the Society of Friends led to his being "cut off from fellowship from them." His son became a manufacturer of paints and chemicals in the early nineteenth century and a founder of the Philadelphia College of Pharmacy.

Another early American chemical manufacturing firm was that of Christopher Marshall, Jr., and Charles Marshall of the fighting Quakers of Philadelphia. This firm made Glauber's Salt and sal ammoniac as early as 1786. It later became a well known firm of apothecaries. Charles Marshall became the first president of the Philadelphia College of Pharmacy, and when his health failed and his business success was jeopardized, his daughter Elizabeth (Betsy Marshall) carried on as an early American woman pharmacist, training many apprentices who later became noted pharmacists.

John Harrison, another member of the Society of Friends, who had studied under Doctor



[illegible]

PHARMACOPOEIA
SIMPLICIORUM
ET
EFFICACIORUM,
IN USUM
NOSOCOMII MILITARIS,
AD EXERCITUM
Fœderatarum *Americæ* Civitatum
PERTINENTIS;
HODIERNÆ NOSTRÆ INOPIÆ RERUMQUE ANGUSTIIS,
Feroci hostium sævitiæ, belloque crudeli ex [illegible] patriæ nostræ illato debitis,
MAXIME ACCOMMODATA.

PHILADELPHIÆ:
EX OFFICINA STYNER & CIST. MDCCLXXVIII.

DISTINGUUNTUR asterisco medicamentorum formulæ, quæ apud commune operum præparari et componi debent; cæteræ inter nosocomiorum officinas sunt extemporè miscendæ.

Plurimæ [illegible] formulæ solidæ *et* siccæ *quæ commodius [illegible] elegantius* liquidâ formâ *adhiberi [illegible] phialarum copia; et omnia, [illegible], pro* recipientibus *[illegible] sunt, quales aquæ [illegible], &c. variaque emplastra et unguenta vix necessaria aut utilia, transportandi incommodo vitare velimus.*

Lititz, *Martii* 12, 1778.

Moses Bloomfield.

PHARMACOPOEIA, &c.

PARS I.
MEDICAMENTA INTERNA.

1. AQUA ACIDULA, (*Posca* Roman.)

REC. Aceti vinosi, vel.
pomacei, *unc.* iv, vel
Pulv. crem. tartar. *drachm.* ii.
Aquæ fontanæ *lib.* ifs. Misce.
Pro potu communi antiseptico, *unc.* iv. 6ties die, vel ad libitum, fumendæ:

Addi possint, pro re nata, spiritus vini tenuis *unc.* ii.

2. AQUA VINOSA.

REC. Vini Maderensis *unc.* viii. vel
rubri *unc.* xii.
Aquæ fontanæ *lib.* i. Misce.
A 2 Pro

4

FIG. 53.—FIRST FOUR PAGES OF A COPY OF THE *United States Military Pharmacopoeia* OF 1778. SEE PAGE 410.

Priestley, was the first American manufacturer of sulphuric acid by the lead chamber process, the plant for which was erected in 1804. The Harrison Chemical Works of the present time specializes in heavy chemicals and paints.

The next chemical manufacturers of importance in the new world were Farr and Kunzi, who began operations in 1812 and later developed into the well known firm of Powers and Weightman, now the Powers-Weightman-Rosengarten Co. The Rosengartens had established themselves in the same line in 1829.

In other lines discoveries and accomplishments had kept pace as well, and the foundations were laid for the material progress that was to characterize the nineteenth century as a whole. In 1818 Lænnec invented the stethoscope. In 1828 Wöhler performed the famous experiment which broke down the distinction between organic and inorganic chemistry by synthetically preparing urea by the simple heating of ammonium cyanate. In 1834 the Spanish Inquisition was abolished. In 1837 the Morse telegraph clicked its first message across the wires. In 1839 Daguerre discovered and made known the fundamental principles of photography. In 1842 Dr. Crawford W. Long of Georgia performed

the first operation using ether as a general anesthetic, followed within a few years by Dr. Charles T. Jackson and Dr. W. T. G. Morton of New England. In 1847 Sir J. Y. Simpson used chloroform for the same purpose.

An interesting pharmaceutical work published in the early part of the nineteenth century is Paris's *Pharmacologia,* which went through at least six editions within five years after its first appearance in 1820. The author of this work was John Ayrton Paris, M.D., F.R.S., F.L.S., Fellow of the Royal College of Physicians of London, Honorary Member of the Board of Agriculture; Fellow of the Philosophical Society of Cambridge; Fellow of the Royal Medical Society of Edinburgh, and Senior Physician to the Westminster Hospital.

The work is in two volumes of about five hundred pages each, and each has a complete index. A very brief study of it impresses one with the fact that the author was a physician of excellent training and high ideals, for he criticizes unmercifully the quacks and charlatans of his day and publishes the composition of many popular nostrums and points out their defects. He was a veritable " Council on Pharmacy and Chemistry " in himself, and pointed out evils which it took the

better part of a century to eradicate. He is often worth quoting. Speaking of Dalby's Carminative, a celebrated nostrum of his time, which is now recognized by the National Formulary under the title *Mistura Carminativa,* he says:

> In examining the pretensions of the combination it must be allowed that it is constructed upon philosophical principles; this, however, is no reason why the physician should recommend it. The mischievous tendency of a quack medicine does not depend upon its composition but upon its application; if its composition is judicious why do not physicians order the same in a regular prescription rather than in a form in which the most valuable remedy will be abused?

This is exactly the attitude which has been taken toward nostrums by those physicians and pharmacists who have the interest of their professions and of the public sincerely at heart.

Paris also gives, in another portion of his work, in commenting upon Battley's Sedative (a popular narcotic nostrum of his time), an excellent definition of a nostrum in the following language:

> Every medicine prepared by a secret process and sold for the private advantage of an individual is a nostrum.

What could be more concise and complete?

Paris was a free lance protector of the public long before a "Food and Drugs Act" was ever

conceived. One of his most notable exposures was of Godbold's Vegetable Balsam, " a nostrum recommended for consumption."

Forty-two different vegetables distilled separately and each made into a separate syrup later to be mixed with the following gums and drugs, viz., gum dragon, gum guaiacum, gum arabic, and gum Canada, these being dissolved in double distilled vinegar with a quantity of storax dissolved in spirits of wine and oil of cinnamon. It is to be then bottled and kept for three years before it is fit to be administered for the cure of consumption, or any asthmatic complaint.

Of this Paris says:

It is hardly necessary to observe that no such directions are, or indeed ever could be, followed; in short, the Balsam is little less than simple oxymel.

He mentions that such remedies are " turned to account by some of those worthy disciples of Æsculapius who live by the credulity of mankind, and as Falstaff expresses it, ' turn diseases to a commodity.' " He also adds pointedly that " Stimulating syrups will frequently remove hoarseness."

Paris discloses the composition of the then secret nostrums, *Godfrey's Cordial, Seidlitz Powders,* and the *Sodaic Powders* which were similar to Seidlitz Powders in their method of administration and effect, and which consisted simply of

sodium bicarbonate in a blue paper and tartaric acid in a white paper.

Paris is cultured, philosophical, practical and epigrammatic in his work, which is really a commentary on the *London Pharmacopœia* of his time and in that respect resembles our modern dispensatories. He cleverly compares the legend of Hannibal using vinegar to aid in crossing the Alps, by dissolving the rocks therewith, with Napoleon's imposition of a tax on salt prior to his Italian campaign, saying that "Hannibal crossed the Alps with vinegar but Napoleon crossed it with salt." This was a time when most of the nations of the world imposed heavy taxes upon the necessities of life, of which salt is an example.

Paris is also the author of a work on medical chemistry, published in an American edition in 1825, which is superior to most works of the same kind of that period. He is the author, also, of a life of Sir Humphrey Davy, which is mentioned in the Encyclopedia Brittanica.

The most remarkable fact about Paris and his interesting work is this—that although his books are fairly common in libraries which date back to his period, and are frequently available at a low price in second hand book stores, neither the author nor his work are mentioned by any phar-

maceutical or medical historian, such as Schelenz, Berends, Wootton, Garrison, etc.

The early part of the nineteenth century was the period when many works on chemistry appeared, some of which were in the form of catechisms, and others of conversations. There were many quacks and charlatans in the beginning of this century in both medicine and pharmacy. Probably the most famous of these was Dr. Elisha Perkins whose healing device was an outstanding example of how fraud and credulity go hand in hand when given the opportunity. The instrument was known as "Perkins' Metallic Tractors," and it took advantage of the mysterious force called electricity, which was in its earliest stages of experimentation and development.

Doctor Brodum, another quack of this period, amassed a fortune selling a "nervous cordial," claimed to be "a guide to old age." We are not informed what a "nervous" cordial was, nor what made it nervous.

A certain Doctor Solomon of Newcastle, England, originally a blacking manufacturer, settled in Liverpool and issued a *Guide to Health*, in which was advertised a nostrum called *Balm of Gilead*. This was claimed to be made of virgin gold and balsam of Mecca. It actually consisted only of aromatic brandy, which was sold for a

guinea a bottle, at a time when brandy was worth only a couple of shillings a quart. A versifying critic of the time is quoted concerning both of these quacks, as follows:

> "Brodum or Solomon with physick
> Like death dispatch the wretch that's sick,
> Pursue a sure and thriving trade;
> Though patients die, the doctor's paid!
> Licensed to kill he gained a palace
> For what another mounts the gallows."

There nostrums were not confined to Great Britain, for one of the most audacious of distributors of nostrums in the new world, was Dr. T. W. Dyott of Philadelphia, who did business over a wide geographic area in the eastern part of the United States. No one in the country carried on such an extensive business in panaceas at that time. He was a frequent advertiser in the newspapers of his day and the certificates or testimonials of cures by remedies sold by him often occupied half a page for days at a time. In these advertisements he always featured a picture of his store with Conestoga wagons drawn up around it to carry his medicines to suffering mankind in the East, West, North, and South. He was a glass bottle manufacturer, dealt in drugs, medicines, chemicals, paints, garden seeds, dyers' supplies, pottery, snuff, chewing tobacco, spices,

chocolate, meats, candy, cowskin whips, and liquors. He advertised " approved family medicines which are celebrated for the cure of most diseases to which the human body is liable, prepared only by the sole proprietor."

He had agents in New York, New Orleans, Cincinnati, and other distant cities. If he could not sell for cash he would accept in barter any of the following items: rosin, turpentine, lampblack, cheese, rye whisky, apple whisky, peach brandy, pearl ash, flaxseed, bristles, rags, mackerel, and real estate in or near Philadelphia.

This practice of accepting commodities in lieu of cash had existed since the early days of the colonies. In addition to the great variety of natural or home manufactured products named in the above list, retail dealers in many lines had been accepting in place of currency, wool, tobacco, skins of various animals and even produce. An illustration of a handbill printed during the latter part of the eighteenth century is shown in illustration No. 55, opposite page 492.

This is interesting, not only for the quaintness and modesty of its advertising claims, but on account of the announcement of " wood ashes " being accepted as legal tender. How would the modern pharmacist like to do business under such conditions? A country customer with a prescrip-

tion bringing a couple of bushels of wood ashes or a sack of potatoes in payment, would be rather embarrassing.

The commerce in those days in all lines was carried on under a guiding principle expressed best by the phrase *caveat emptor* (let the buyer beware). The changing character of trade, the abandonment of many arts which were home industries in colonial days, and the appearance of legislative enactments protecting the purchaser, has led to a complete reversal of conditions in our own time, and the exemplifying phrase today is *caveat venditor* (let the seller beware).

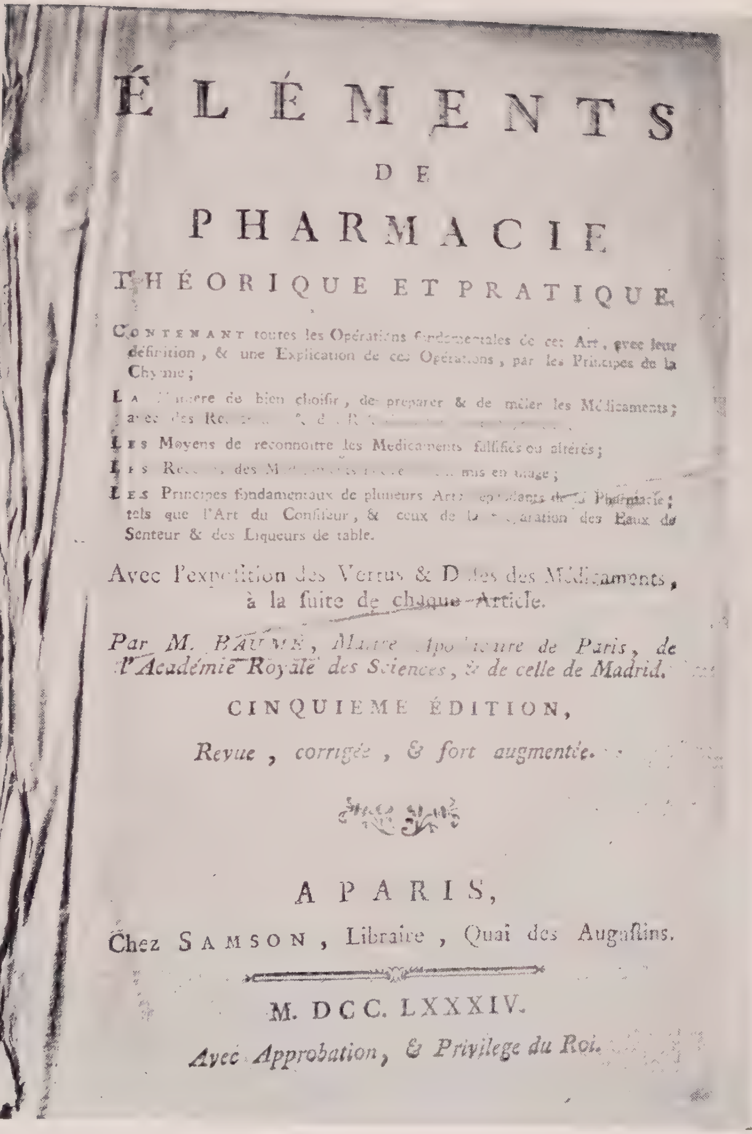
Dyott claimed to be a grandson of a celebrated Edinburgh physician named Doctor Robertson, whose prescriptions formed the basis for many of his nostrums. He claimed that a million persons had been cured by the remedies he sold. The nostrum evil in those days was bravely attacked by some of the early pharmaceutical organizations. The Philadelphia College of Pharmacy in 1824 published a small volume containing *Formulæ for the Preparation of Eight Patent Medicines.* These formulas were circulated among the medical practitioners so that they might know the composition of these secret remedies and inform their patients regarding them, for almost all of them were similar in character to

drugs or combinations which were in common use and described in the pharmacopœias of the period.

The New York College of Pharmacy, which was founded in 1829 as a teaching institution in that city, started out along the same line of exposing the nostrums of the day. They made an unfortunate choice in one of the early lists and a threatened libel suit jeopardized their very existence for a short time.

Warburg's Tincture, which is now an honored member of the galaxy of official preparations and in good repute, started its career as a nostrum about the middle of the nineteenth century. It was originally prepared by an Austrian physician, Dr. Carl Warburg, who soon achieved an extraordinary success in his practice in the treatment of intermittent fevers and agues with this preparation.

Even while it was controlled by him as a secret medicine the Austrian Ministry of Health placed it upon the list of remedies which the pharmacist was required to keep in stock—an unusual distinction for a nostrum. Some time thereafter a medical commission was appointed to examine it and report upon its composition. This commission made several independent analyses and subsequently agreed upon a formula for an equivalent preparation.



ÉLÉMENTS
DE
PHARMACIE
THÉORIQUE ET PRATIQUE.

CONTENANT toutes les Opérations fondamentales de cet Art, avec leur définition, & une Explication de ces Opérations, par les Principes de la Chymie;

LA Maniere de bien choisir, de préparer & de mêler les Médicaments; avec des [illegible]

LES Moyens de reconnoître les Médicaments falsifiés ou altérés;

LES Re[illegible] des M[illegible] mis en usage;

LES Principes fondamentaux de plusieurs Arts dépendants de la Pharmacie; tels que l'Art du Confiseur, & ceux de la [illegible]aration des Eaux de Senteur & des Liqueurs de table.

Avec l'exposition des Vertus & Doses des Médicaments, à la suite de chaque Article.

Par M. BAUMÉ, Maître Apothicaire de Paris, de l'Académie Royale des Sciences, & de celle de Madrid.

CINQUIEME ÉDITION,

Revue, corrigée, & fort augmentée.

A PARIS,
Chez SAMSON, Libraire, Quai des Augustins.

M. DCC. LXXXIV.

Avec Approbation, & Privilege du Roi.

FIG. 54.—TITLE-PAGE OF THE MOST FAMOUS EIGHTEENTH CENTURY WORK ON PHARMACY, WRITTEN BY ANTOINE BAUMÉ. SEE PAGE 366.

Later the original nostrum acquired a great reputation in India, and many remarkable testimonials were given of its efficacy, and the statement was made by one of the Royal Engineers that "great engineering works carried on in deadly jungles had been brought to a successful issue mainly through the protection to workmen afforded by this tincture."

At this time another formula was published which was alleged to be the original formula used by Doctor Warburg himself. Subsequently it was discovered that Doctor Warburg was living in poverty in London, having dissipated the large fortune which he had acquired from the sale of the remedy. The Indian office of the British government immediately made a grant for his relief and he lived out his declining years as a ward of the British Empire.

The evolution of pharmacopœias in the beginning of the nineteenth century tended toward centralization and simplification. The first national pharmacopœia of importance was the *French Codex* of 1818. While this was a great improvement over the local pharmacopœias which it replaced, it still retained some of the monstrous and unscientific formulas of bygone centuries. For example, there was a formula for theriac, this time under the expressively correct title of

electuarium opiatum polypharmacum, which contained seventy-two ingredients. The first revision of the *London Pharmacopœia* in the nineteenth century did not contain a formula for theriac, but it was dismissed by a bare majority of only one vote of the twenty-seven committee members who voted.

As an example of an unscientific formula the *French Codex* of 1818 contained one for an extract of opium, in which the preparation was to be boiled incessantly for six months, constantly replacing the water lost by evaporation.

Several dispensatories appeared at about this time, one in 1806 by Dr. John Redman Coxe, Professor of Chemistry in the medical department of the University of Pennsylvania, and another in 1810 by Dr. James Thatcher of Boston, Massachusetts, the latter being based on the pharmacopœia issued by the medical society of that State.

In the new world the first local pharmacopœia to appear was that published in 1808 by the Massachusetts Medical Society. Another local pharmacopœia appeared in 1816 in New York, this time under the auspices of the New York Hospital. The title of this work was *Pharmacopœia Nosocomii Neo Eboratensis.* This contained a list of maximum doses of potent remedies.

The time was auspicious for a national pharmacopœia in the United States, and in 1816 Dr. Lyman Spalding of Cornish, New Hampshire, made the first suggestion leading to the consummation of this end. The history of the first *United States Pharmacopœia,* which appeared in 1820, and of its successive decennial revisions up to the present time, has been so frequently written and is given in such concise and readable form in the preface to the latest edition of that important work, that it is unnecessary to repeat it here. It may be mentioned in passing, however, that while the *United States Pharmacopœia* was originated and entirely controlled by the medical profession in its early editions, the foothold which the pharmacists first gained in 1850 has increased, so that at the present writing and for some decades past, the work may be said to be controlled by pharmacists, as they predominate in the Revision Committee. No other national pharmacopœia of importance is thus dominated by pharmacists, and in some countries the pharmacists have little responsibility or authority in connection with pharmacopœial revision. In comparison with the pharmacopœias of other nations the *U.S.P.* stands very high. Doctor Schelenz has stated that "the United States Pharmacopœia is the peer of all the pharmacopœias of the world."

The first *British Pharmacopœia* did not appear until 1864, when it replaced the pharmacopœias of London, Edinburgh, and Dublin. The first *German Pharmacopœia* was issued in 1872, when it took the place of nearly a score of local pharmacopœias in that country.

The grinding or pulverizing of drugs and chemicals on the large scale was unknown prior to the nineteenth century. The resounding clank of the contusion mortar and pestle was forever heard in the land. One memorable day toward the middle of this century which brought so many time- and labor-saving changes to the pharmacist, a wholesale druggist of Philadelphia complained to a group of friends regarding the difficulty of pulverizing cream of tartar, which prior to that time, had all been powdered by hand with a mortar and pestle.

Among the group of listeners was a paint grinder, Charles Hagner, a member of a firm that has long since gone out of business. Hagner, having in mind the efficiency of one of his newly installed paint grinding mills told his wholesale druggist friend to send him a barrel of cream of tartar crystals and he would see what could be done about it. The next day following the sending of the barrel of these hard crystals to the paint grinder, the wholesale druggist received it back

in a finely pulverized condition. He could not believe it possible for the work to be accomplished so quickly, for by his own method of procedure the work would have taken weeks. He called an informal meeting of some of his friends in the wholesale drug and chemical trade and they applied tests to the material in the belief that something had been substituted for the genuine article. When they were convinced that the undreamed-of result had actually been accomplished, they rejoiced, and a new industry was born in Philadelphia which had for its object, first, the grinding of chemicals, and later, of drugs.

The result was, that instead of the contusion mortar being the most prominent piece of apparatus in the retail pharmacy it was soon relegated to the background, and by the end of the century the old-fashioned mortar and pestle were rarely seen in the pharmacy at all.

The first description of " soda water," as the term is now used, was in the writings of Joseph Priestley in 1772, when he gave " directions for impregnating water with fixed air to communicate the peculiar spirit and virtues of Pyrmont water."

The manufacture of carbonated waters on the large scale was begun at Geneva in 1790 by Nicholas Paul. Later a substitute for the me-

chanically prepared carbonated waters was introduced in which the aeration was produced by reaction between salaeratus (baking soda) and tartaric acid, and the name " soda water " came into general use. Such a product had slightly laxative properties and was the equivalent of the product made by mixing the component parts of the well known " sodaic powders."

This method of carbonating water soon was cast aside and the earlier method of impregnating water with the gas under pressure was revived. Under the erroneous name of soda water the product soon became popular in America. The first " soda fountains," as they were called, were found exclusively in drugstores, and many a pharmacist of the present day can recollect the time when he risked his life and obtained his first lessons in applied chemistry learning to operate the " generator " in the cellar, where carbon dioxide was evolved by the action of commercial sulphuric acid on marble dust or baking soda.

Percolation came into existence in the early part of the nineteenth century. Maceration had been employed for many centuries. Sometimes the directions for maceration required the operation to be conducted in the light for a certain number of days, and the large containers of tinc-

tures in the process of manufacture, often two or three gallons in size, which usually stood in the pharmacist's front window, evolved in later years into the show bottles of colored liquids which characterized the drugstores of the latter part of the nineteenth century.

The process of extracting wood ashes of their soluble salts (principally potassium carbonate), in a lye hopper, had long been carried out as a household operation in rural communities and was known as "lixiviation."

In 1813 a form of apparatus similar to a percolator was employed in France by Dumont in decolorizing syrups by the use of charcoal. At the same time a percolator type of extraction apparatus was used in the *Cafetiere de Dubelloy,* in the preparation of coffee. In 1815 the first recorded instance of the application of the principle to powdered drugs was made by Count Real. M. Robiquet subsequently employed percolation in connection with his research work upon bitter almond and its oil. The Boullays of Paris, however, were the workers who first made extensive experiments upon percolation as applied to a number of drugs.

For some reason or other the process never became popular in France and was ignored in

Germany. In America, however, it was taken up with enthusiastic interest and the researches and experiments of such eminent workers as Duhamel, Procter, Grahame, Squibb, Diehl, Oldberg, and others placed it in the front rank of distinctive pharmaceutical practices applicable to either large or small scale operations. A very complete history of percolation has been written by James F. Couch and was published in the *American Journal of Pharmacy* for 1919.

Several colleges of pharmacy were instituted in the first half of the nineteenth century in addition to the colleges in Philadelphia and New York, already mentioned. The Massachusetts College of Pharmacy, founded in 1823 as a scientific organization, started teaching and class work about thirty-five years later. The Maryland College of Pharmacy was founded in 1841.

In these several colleges the subject of pharmacy for many years was taught by medical members of the Faculty in conjunction with the branch of materia medica. The first individuals to hold separate professorships in pharmacy were Professor George W. Andrews and Professor Thomas Mackenzie in Baltimore in 1841, and Professor William Procter, Jr. in Philadelphia in 1846.

In 1848 the first formal comprehensive code of pharmaceutical ethics ever issued was adopted and promulgated by the Philadelphia College of Pharmacy. This reflects so clearly the state of pharmacy of the time that it is quoted here in full:

A CODE OF ETHICS ADOPTED BY THE PHILADELPHIA COLLEGE OF PHARMACY

Pharmacy being a profession which demands knowledge, skill, and integrity on the part of those engaged in it, and being associated with the medical profession in the responsible duties of preserving the public health, and dispensing the useful though often dangerous agents adapted to the cure of disease, its members should be united on some general principles to be observed in their several relations to each other, to the medical profession, and to the public.

The Philadelphia College of Pharmacy being a permanent, incorporated institution, embracing amongst its members a large number of respectable and well educated apothecaries, has erected a standard of scientific attainments, which there is a growing disposition on the part of candidates for the profession to reach; and being desirous that in relation to professional conduct and probity, there should be a corresponding disposition to advance, its members having agreed upon the following principles for the government of their conduct:

First. The College of Physicians of Philadelphia having declared that any connection with, or monied interest in apothecaries' stores, on the part of the physicians, should be discountenanced; we in like manner consider that an apothecary being engaged in furthering the interests of any particular physician, to the prejudice of other reputable

members of the medical profession, or allowing any physician a percentage or commission on his prescriptions, as unjust toward that profession and injurious to the public.

2d. As the diagnosis and treatment of disease belong to the province of a distinct profession, and as a pharmaceutical education does not qualify the graduate for these responsible offices; we should, where it is practicable, refer applicants for medical aid to a regular physician.

3d. As the practice of Pharmacy can only become uniform, by an open and candid intercourse being kept up between apothecaries, which will lead them to discountenance the use of secret formulæ, and promote the general use and knowledge of good practice, and as this College considers that any discovery which is useful in alleviating human suffering, or in restoring the diseased to health, should be made public for the good of humanity and the general advancement of the healing art—no member of this College should originate or prepare a medicine, the composition of which is concealed from other members, or from regular physicians.

Whilst the College does not at present feel authorized to require its members to abandon the sale of secret or quack medicines, they earnestly recommend the propriety of discouraging their employment, when called upon for an opinion as to their merits.

4th. The apothecary should be remunerated by the public for his knowledge and skill, and his charges should be regulated by the time consumed in preparation, as well as by the value of the article sold; although location and other circumstances necessarily affect the rate of charges at different establishments, no apothecary should intentionally undersell his neighbors with a view to his injury.

5th. As medical men occasionally commit errors in the

Samuel Whiting,

Next Door to the Court-Houſe, Great-Barrington,
Has a handſome (little) Aſſortment of

Dry Goods and Groceries.

He flatters himſelf that thoſe who pleaſe to call on him, will not be diſſatisfied with the Quality or Price of his GOODS.

Abraham K. Whiting,

At the ſame Store,
Is furniſhed with a moderate retailing Aſſortment of

MEDICINES:

Where Gentlemen of the Faculty, who favour him with their Recipes, may depend on having *juſtice* done their Preſcriptions.

⁂ *THEY deal for* ready Pay *only, and will allow the higheſt Price for* ASHES in their Seaſon, *and other Articles of Produce uſual in the Mercantile Line.*

NEW-YORK: Printed by W. MORTON, at his Printing-Office, No. 231, Queen-Street.

FIG. 55.—HANDBILL OF AN ADVERTISEMENT OF AN EIGHTEENTH CENTURY PHARMACY, WITH NOTE CONCERNING THE ACCEPTANCE OF "WOOD ASHES" IN LIEU OF CURRENCY. SEE PAGE 480.

phraseology of their prescriptions, which may or may not involve ill consequences to the patient if dispensed, and be injurious to the character of the practitioner; it is held to be the duty of the apothecary, in such cases, to have the corrections made, if possible, without the knowledge of the patient, so that the physician may be screened from censure. When the errors are of such a character as not to be apparent, without the knowledge of circumstances beyond the reach of the apothecary, we hold him to be blameless in case of ill consequences, the prescription being his guarantee, the original of which should always be retained by the apothecary.

6th. Apothecaries are likewise liable to commit errors in compounding prescriptions—first, from the imperfect handwriting of the physicians; secondly, owing to the various synonyms of drugs in use, and their imperfect abbreviations; thirdly, from the confusion which even in the best regulated establishments, may sometimes occur, arising from press of business; and fourthly, from deficient knowledge or ability of one or more of the assistants in the shop, or of the proprietor—

We hold that in the first three instances named, it is the duty of the physician to stand between the apothecary and the patient, as far as possible; and in the last that he should be governed by the circumstances of the case—drawing a distinction between an error made by a younger assistant accidentally engaged, and a case of culpable ignorance or carelessness in the superior.

7th. As the apothecary should be able to distinguish between good and bad drugs, in most cases, and as the substitution of a weak or inert drug for an active one, may, negatively, be productive of serious consequences—we hold that the intentional sale of impure drugs or medicines, from

motives of competition, or desire of gain, when pure articles of the same kind may be obtained, is highly culpable, and that it is the duty of every honest apothecary or druggist to expose all such fraudulent acts as may come to his knowledge. But in reference to those drugs which cannot be obtained in a state of purity, he should, as occasion offers, keep physicians informed as to their quality, that they may be governed accordingly.

8th. As there are many powerful substances that rank as poisons, which are constantly kept by apothecaries, and prescribed by physicians, and which are only safe in their hands, as arsenious acid, vegetable alkaloids, ergot, cantharides, etc.—we hold that the apothecary is not justified in vending these powerful agents indiscriminately to persons unqualified to administer them, and that a prescription should always be required, except in those cases when the poisons are intended for the destruction of animals or vermin—and in these instances only with the guarantee of a responsible person. And we hold that when there is good reason to believe that the purchaser is habitually using opiates or stimulants to excess, every conscientious apothecary should discourage such practice.

9th. No apprentice to the business of apothecary should be taken for a less term than four years, unless he has already served a portion of that time in an establishment of good character. Apprentices should invariably be entered as matriculants in the school of pharmacy and commence attendance on its lectures at least two years before the expiration of their term of apprenticeship; and as the progress of our profession in the scale of scientific attainment must depend mainly upon those who are yet to enter it—it is recommended that those applicants who have had the

advantage of a good preliminary education, including the Latin language, should be preferred.

DANIEL B. SMITH, *President.*
CHARLES ELLIS, *1st Vice-President.*
SAMUEL F. TROTH, *2nd Vice-President.*
Attest: DILLWYN PARRISH, *Secretary.*

Scientific organizations of many types had appeared during the first half of the nineteenth century, but no pharmaceutical body had yet been evolved. In 1811 a chemical society had been formed called The Columbian Chemical Society. In 1815 the Academy of Natural Sciences of Philadelphia, the first scientific organization of its kind in the country, was founded. It had its origin in a group of naturalists who had their first meeting in the drugstore of Townsend Speakman, a well known pharmacist of his time in Philadelphia and an ancestor of Professor Joseph P. Remington. The Massachusetts Institute of Technology, was founded in 1861 and the School of Mines of Columbia University in 1864.

The Franklin Institute, another scientific organization of world wide fame was founded in Philadelphia in 1825. Of scientific schools in America the Renssalaer Polytechnic Institute is the oldest, having been started in 1824. The Sheffield Scientific School of Yale did not have a beginning until 1846, while the Lawrence School of Science at Harvard was originated in 1847.

The Pharmaceutical Society of Great Britain was founded in 1841. The time was ripe for a national organization in pharmacy in this country, and the American Pharmaceutical Association was the first one to appear. It had its inception in a preliminary meeting of prominent pharmacists in New York City in 1851, and the first formal meeting was held in Philadelphia in 1852. The officers elected were representative of various phases of pharmacy and were well distributed geographically. They were Daniel B. Smith of Philadelphia, President; George W. Andrews of Baltimore, First Vice President; Samuel L. Colcord of Boston, Second Vice President; C. Augustus Smith of Cincinnati, Third Vice President; Alfred B. Taylor of Philadelphia, Treasurer; George D. Coggeshall of New York, Recording Secretary; and William Procter, Jr. of Philadelphia, Corresponding Secretary.

Among the prominent pharmacists, besides Daniel B. Smith, who held the office of President of the American Pharmaceutical Association during its first fifty years, were George W. Andrews of Baltimore, Charles Ellis of Philadelphia, Samuel L. Colcord of Boston, Henry T. Kiersted of New York, William Procter, Jr. of Philadelphia, Frederick Stearns of Detroit, John Milhau of New York, Edward Parrish of Phila-

delphia, Enno Sander of St. Louis, Albert E. Ebert of Chicago, John F. Hancock of Baltimore, C. Lewis Diehl of Louisville, George F. H. Markoe of Boston, Charles Bullock of Philadelphia, William Saunders of London, Ontario, George W. Sloan of Indianapolis, P. W. Bedford of New York, William S. Thompson of Washington, Charles H. Tuft of New Hampshire, John Uri Lloyd of Cincinnati, Emlen Painter of New York, A. B. Taylor of Philadelphia, Joseph P. Remington of Philadelphia, Edgar L. Patch of Boston, William Simpson of Raleigh, James M. Good of St. Louis, Charles E. Dohme of Baltimore, Albert B. Prescott of Ann Arbor, and Henry M. Whelpley of St. Louis.

The most prominent among the other office holders in the Association during its first half century were Treasurer Samuel A. D. Sheppard of Boston, Recording Secretary Edward Parrish of Philadelphia, and Corresponding Secretary (later Permanent Secretary) John M. Maisch of Philadelphia.

It is impossible in an outline history of this type to give biographical sketches of the pharmacists in the foregoing list. They may be found scattered through the Proceedings of the American Pharmaceutical Association. In the history

of the earlier centuries biographical sketches have frequently been included for the reason that in these cases no easily accessible records are available.

We are more concerned in this century with events and the relation which individuals or organizations bear toward these events. One of the first accomplishments of the American Pharmaceutical Association was to formulate its own code of ethics. This is so concise and distinctive and had such an important influence, along with the earlier code of the Philadelphia College of Pharmacy, upon the codes of the various State pharmaceutical associations that it too is here quoted in full.

CODE OF ETHICS OF THE AMERICAN PHARMACEUTICAL ASSOCIATION

The American Pharmaceutical Association, composed of Pharmaceutists and Druggists throughout the United States, feeling a strong interest in the success and advancement of their profession in its practical and scientific relations, and also impressed with the belief that no amount of knowledge and skill will protect themselves and the public from the ill effects of an undue competition, and the temptations to gain at the expense of quality unless they are upheld by high moral obligations in the path of duty, have subscribed to the following Code of Ethics for the government of their professional conduct.

Article 1. As the practice of pharmacy can only become uniform by an open and candid intercourse being kept up

between apothecaries and druggists among themselves and each other, by the adoption of the National Pharmacopœia as guide in the preparation of official medicines, by the discontinuance of secret formulæ and the practices arising from a quackish spirit, and by an encouragement of that *esprit de corps* which will prevent a resort to those disreputable practices arising out of an injurious and wicked competition; Therefore, the members of this Association agree to uphold the use of the Pharmacopœia in their practice; to cultivate brotherly feeling among the members, and to discountenance quackery and dishonorable competition in their business.

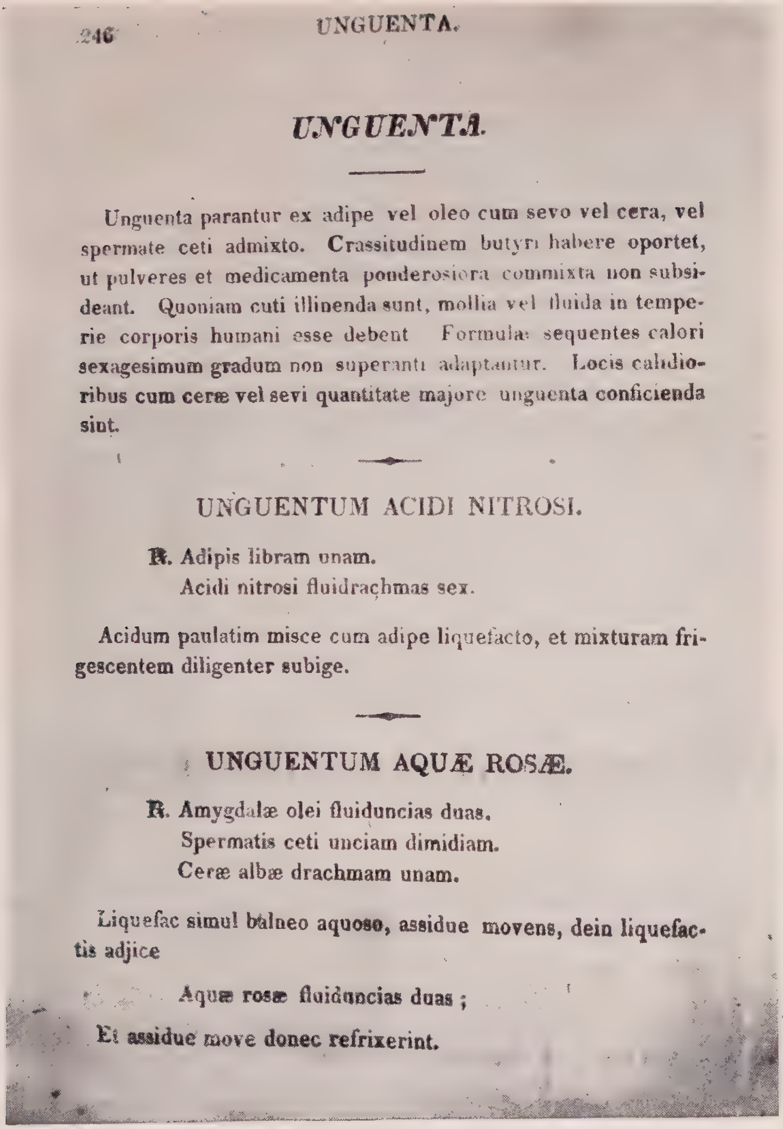
Art. 2. As labor should have its just reward, and as the skill, knowledge and responsibility required in the practice of pharmacy are great, the remuneration of the pharmaceutist's services should be proportioned to these, rather than to the market value of the preparations vended. The rate of charges will necessarily vary with geographical position, municipal location, and other circumstances of a permanent character, but a resort to intentional and unnecessary reduction in the rate of charges among apothecaries, with a view to gaining at the expense of their brethren, is strongly discountenanced by this Association as productive of evil results.

Art. 3. The first duty of the apothecary, after duly preparing himself for his profession, being to procure good drugs and preparations (for without these his skill and knowledge are of small avail), he frequently has to rely on the good faith of the druggist for their selection. Those druggists whose knowledge, skill and integrity enable them to conduct their business faithfully, should be encouraged, rather than those who base their claims of patronage on the cheapness of their articles solely. When accidentally

or otherwise, a deteriorated, or adulterated drug or medicine is sent to the apothecary, he should invariably return it to the druggist, with a statement of its defects. What is too frequently considered as a mere error of trade on the part of the druggist, becomes a highly culpable act when countenanced by the apothecary; hence, when repetitions of such frauds occur, they should be exposed for the benefit of the profession. A careful but firm pursuit of this course would render well disposed druggists more careful and deter the fraudulently inclined from a resort to their disreputable practices.

Art. 4. As the practice of pharmacy is quite distinct from the pratice of medicine, and has been found to flourish in proportion as its practitioners have confined their attention to its requirements; and as the conduction of the business of both professions by the same individual involves pecuniary temptations which are often not compatible with a conscientious discharge of duty; we consider that the members of this Association should discountenance all such professional amalgamation; and in conducting business at the counter, should avoid prescribing for diseases when practicable, referring applicants for medical advice to the physician. We hold it as unprofessional and highly reprehensible for apothecaries to allow any percentage or commission to physicians on their prescriptions, as unjust to the public, and hurtful to the independence and self respect of both the parties concerned. We also consider that the practice of some physicians (in places where good apothecaries are numerous), of obtaining medicines at low prices from the latter, and selling them to their patients, is not only unjust and unprofessional, but deserving the censure of all high-minded medical men.

Art. 5. The important influence exerted on the practice


246 UNGUENTA.

UNGUENTA.

Unguenta parantur ex adipe vel oleo cum sevo vel cera, vel spermate ceti admixto. Crassitudinem butyri habere oportet, ut pulveres et medicamenta ponderosiora commixta non subsideant. Quoniam cuti illinenda sunt, mollia vel fluida in temperie corporis humani esse debent Formulæ sequentes calori sexagesimum gradum non superanti adaptantur. Locis calidioribus cum ceræ vel sevi quantitate majore unguenta conficienda sint.

UNGUENTUM ACIDI NITROSI.

℞. Adipis libram unam.
Acidi nitrosi fluidrachmas sex.

Acidum paulatim misce cum adipe liquefacto, et mixturam frigescentem diligenter subige.

UNGUENTUM AQUÆ ROSÆ.

℞. Amygdalæ olei fluiduncias duas.
Spermatis ceti unciam dimidiam.
Ceræ albæ drachmam unam.

Liquefac simul balneo aquoso, assidue movens, dein liquefactis adjice

Aquæ rosæ fluiduncias duas;

Et assidue move donec refrixerint.

FIG. 56.—SPECIMEN PAGE OF LATIN EDITION OF FIRST *United States Pharmacopoeia.* THIS PAGE BEARS THE FORMULA FOR THE CELEBRATED PREPARATION OF GALEN, NOW COMMONLY KNOWN AS "COLD CREAM." SEE PAGE 485.

of pharmacy by the large proportion of physicians who have resigned its duties and emoluments to the apothecary, are reasons why he should seek their favorable opinion and cultivate their friendship, by earnest endeavors to furnish their patients with pure and well-prepared medicines. As physicians are liable to commit errors in writing their prescriptions, involving serious consequences to health and reputation if permitted to leave the shop, the apothecary should always, when he deems an error has been made, consult the physician before proceeding; yet in the delay which must necessarily occur, it is his duty, when possible, to accomplish the interview without compromising the reputation of the physician. On the other hand, when apothecaries commit errors involving ill consequences, the physician, knowing the constant liability to error, should feel bound to screen them from undue censure, unless the result of a culpable negligence.

Art. 6. As we owe a debt of gratitude to our predecessors for the researches and observations which have so far advanced our scientific art, we hold that every apothecary and druggist is bound to contribute his mite towards the same fund, by noting the new ideas and phenomena which may occur in the course of his business, and publishing them, when of sufficient consequence, for the benefit of the profession.

The Victorian Era, which began in 1837 with the accession to the throne of Great Britain of the grandmother of England's present ruler, had ushered in a period of literary and artistic development which was distinctive and of profound significance to the political historian, but which

had little effect upon pharmacy or science in general. Nor did the various wars of the century seem to have any great influence upon the history of the profession.

The founding of the American Pharmaceutical Association was soon followed by the organization of State pharmaceutical associations, and these with their separate annual meetings helped to develop an embryonic type of class consciousness in pharmacy. Because of the fact that neither the national or state organizations representing pharmacy have ever attracted all of the individuals practicing the profession to the ranks of membership, this class consciousness has never been developed to the same degree that is found to exist in medicine, for instance, when the young practitioner allies himself with his county, state and national organizations immediately upon his entry into the ranks of the practicing members of his profession.

While pharmaceutical organizations were struggling along in the early stages of their development, pharmaceutical education was slowly progressing at first rather by geographical extension than by any real educational advancement. Colleges were organized in many different parts of the country in the latter part of the century. The majority of these, such as Chicago,

Cincinnati, St. Louis, Louisville, San Francisco, and Washington, D.C., were at first established as independent institutions, like many of the medical schools of the same period.

In 1868 the University of Michigan established the first pharmacy department connected with a state university. In 1883 the second school of this type was established at Wisconsin, and in the last decade of the nineteenth century the university schools became so numerous that they have had a predominating influence ever since in promoting educational advancement in pharmacy, that influence being exerted to a more marked degree in the twentieth century.

Pharmacopœial revision and problems pertaining thereto brought new figures into prominence during the latter part of the eighteenth century, in connection with scientific pharmacy. The most noted of these were Dr. Edward R. Squibb of Brooklyn, Dr. Charles Rice of New York, and Professor John M. Maisch of Philadelphia. The first of these specialized in scientific and manufacturing pharmacy; the second in pharmacopœial revision work (he was chairman of the U. S. P. Revision Committee at the time of his death in 1900), and the last became America's greatest worker in pharmacognosy. Professor Maisch was the recipient of

the Hanbury Medal in 1893, the year of his death.

Many factors combined in the nineteenth century to bring about great changes in the practice of pharmacy. These changes were particularly marked in the United States and in Great Britain and her colonies. One of the earliest factors to appear was the introduction of the coated machine-made pill, replacing in large part the pills of extemporaneous preparation. Another factor was the introduction of machine-made plasters, which eliminated the need on the part of the pharmacy student or apprentice of learning the art of plaster spreading with the exception of extemporaneous plasters for blistering purposes. Still another factor was the appearance upon the market of the class of preparations known as medicated elixirs. While the vogue of these reached its peak before the close of the nineteenth century the influence has remained ever since, and the proportion of nauseous and unsightly medicines has remained at a very low figure in comparison with bygone days.

The invention of tablet triturates and compressed tablets had a twofold influence, for these convenient forms of medication not only eliminated a certain amount of extemporaneous compounding in the prescription department, but

actually diminished the number of prescriptions by encouraging physicians to usurp the functions of the pharmacist by dispensing their own medicines. William Brockedon of London and Jacob Dunton of Philadelphia were the pioneers in the manufacture of compressed tablets shortly before the middle of the nineeteenth century.

Another factor of outstanding importance in the nineteenth century, and which affected both pharmacy and medicine, was the appearance of synthetic remedial agents, the "products of the tar barrel," as they have been called. From the unsuccessful search for synthetic quinine which was conducted by Perkin in 1856, and which led to the discovery of the first coal tar dye called "mauve" or "Perkin's purple," came unexpected developments in the way of scientific research.

The alkaloids were the first great pharmaceutical development of the nineteenth century. The introduction of anesthetics was of less importance in its influence than the changing styles of remedies in which the old-fashioned pills, plasters and mixtures gave way to more attractive and palatable dosage forms.

The influence of coal tar chemistry was evidenced along two distinct lines. One of these was concerned with the preparation of remedial

agents. Some of these, such as salicylic and benzoic acids, were synthetic products which were identical with those which had formerly been used under these names as obtained from natural sources. Others were entirely new to science and had no counterpart in nature. Examples of the latter are acetanilid and antipyrin, two of the earliest of the synthetic antipyretics.

The rapid progress which was made in organic chemistry, the study of which had been stimulated first by the synthesis of urea by Wöhler and later by the discovery of mauve by Perkin, would have been impossible had it not been for Dumas, who developed the theory of substitution in chemical formulas; Gerhardt who showed how organic compounds could be classified and grouped into homologous series; Frankland, who elaborated the doctrine of valency; Berzelius, who had given prominence to the idea of compound radicles, and above all, the brilliant contributions of Kekule to the theory of structural formulas and his ingenious conception of the benzene formula as a closed ring.

The other line was in the preparation of antiseptics. The way had been paved in this direction by the researches of Louis Pasteur. Pasteur focussed the attention of the scientific world upon microscopic forms of life and their relation not

only to health and disease but their effect upon certain industries, now called the fermentation industries. The words "microbe" and "bacteria" first came into common use at this time.

It is neither advisable nor necessary to go into great detail in connection with the work of Pasteur and the use that was made of it in surgery by Lister. It is well, however, to call attention to the fact that some of Pasteur's success was due to aid obtained from pharmacists. One of these was Balard, the discoverer of bromine, who furnished the key to the success of Pasteur's experiments in connection with the discussion of the so called spontaneous generation of life. Pasteur could not think of a method of protecting his flasks from infection by the micro-organisms in the air and yet allow access of air. Balard suggested that he curve his exit tubes so that no micro-organism could possibly fall into the cultures, and lo! the problem was solved.

The other was a character of great importance of his time but about whom medical and pharmaceutical historians say little or nothing. His name was Pierre Jacques Antoine Béchamp, who was professor of medical chemistry and pharmacy at the University of Montpellier from 1857 to 1875. Béchamp, had been educated in pharmacy, in science, and in medicine, and had taught

physics and toxicology in the school of pharmacy at Strasburg at the same time that Pasteur held the chair of organic chemistry in the same institution. Béchamp had been awarded medals and prizes for discoveries of value and importance to chemistry and the industries.

The files of the *Comptes Rendus de l'Academie des Sciences* show that Béchamp had worked upon some of the problems for which Pasteur later was given the undivided glory, some years previous to the time when Pasteur's first communications appeared, and that Béchamp had antedated Pasteur both on the subject of fermentation and in the investigation of diseases of the silkworm. The records also show that Béchamp discovered a soluble ferment in yeast and named it zymase, in 1856, while Buchner is given the credit for discovering and naming it forty years later, in 1896.

Besides Pasteur and Béchamp, Koch, Roux, Behring, and Metchnikoff added to the progress in this specialized field of biological science.

Scientific progress in other fields in the nineteenth century had been phenomenal. The appearance of the telephone as a demonstrated success at the Centennial Exposition held in Philadelphia in 1876, held undreamed-of possibilities for the pharmacists of the next succeeding gen-

eration. The phonograph first appeared in 1877 in a form which now would be regarded as a crude toy. In 1880 the cause of malaria was discovered and in 1881 the cause of yellow fever was established. These two diseases, then common, are now rather rare.

In general physics important work had been done by Young, Angstrom, Joule, Graham, Foucault, Tyndall, Helmholtz, Maxwell, Crookes, Rayleigh, Dewar, Nernst, Roentgen, Rowlands, Becquerel, Hertz, Marconi, and Ostwald, a number of whom carried their work well into the following century.

In the specialized field of electricity, besides Faraday and Morse, who have already been mentioned, were Ampere, Ohm, Henry, Wheatstone, and Edison, the last still carrying on for the enrichment of science and the benefit of mankind.

In geology the outstanding characters of the nineteenth century were Silliman, Lyell, Agassiz, and Dana, the last paying particular attention to mineralogy.

In botany the two Bartons, W. C. P. Barton and Benjamin Smith Barton, were ably assisted by Michaux, Cæsalpinus, Nuttall, and Pursh, and these were followed by Brown, Gray, Engler, Prantl, Bentham, and Hooker.

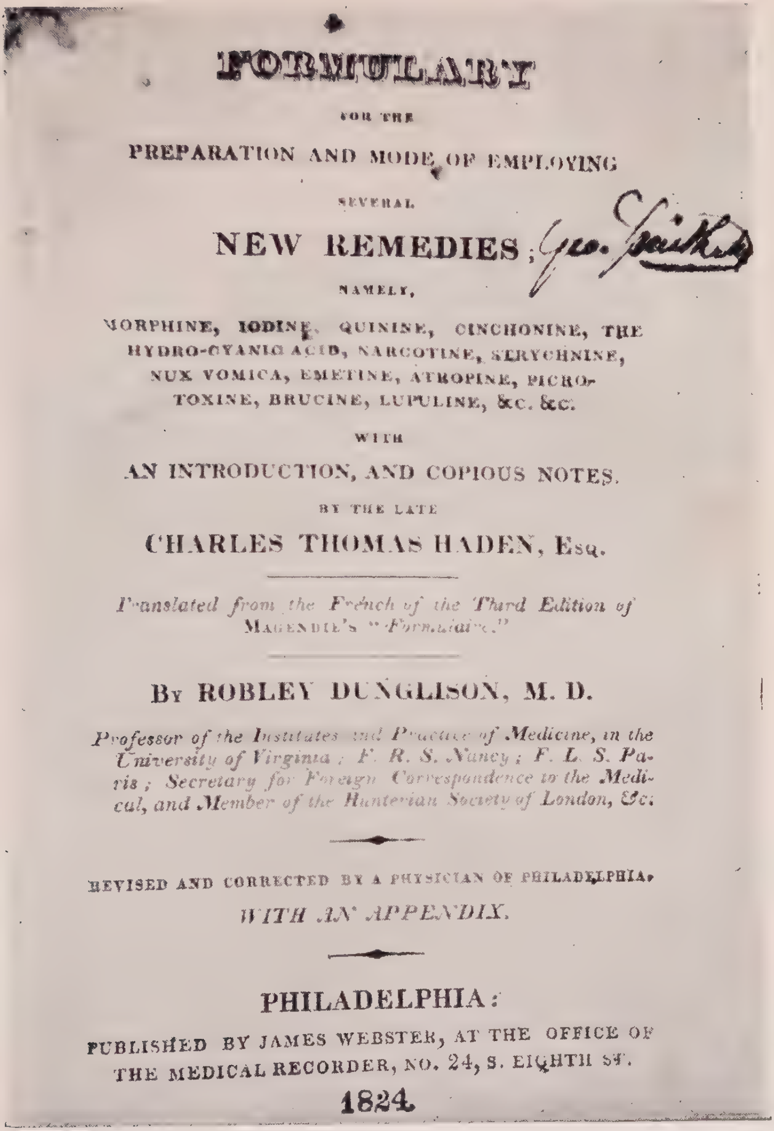
In zoölogy Cuvier and Audubon were the outstanding figures.

In astronomy Newcomb and Lockyer both did work of prime importance, the latter discovering and naming the element helium, now used as a buoyant gas in dirigible balloons, which he found in the photosphere of the sun some years before it was known to exist terrestrially.

In the general field of natural history, including evolution and biology, the most prominent character was Charles Darwin, whose *Origin of Species* and *Descent of Man* started reverberations in the literature of science which have not yet died away. Others who played a significant part in this domain of science were Humboldt, Wallace, Leidy, Fabre, Lubbock, Haeckel, Mendel, Cope, Huxley, and Fiske.

Some of the prominent workers in chemistry in the first half of the nineteenth century have already been named. Among others who were noted up to the end of the century were Newlands, Mendeleef, Regnault, Kopp, Cannizzaro, the Meyers, Stas, Roscoe, Winkler, Kolbe, Hofmann, Nobel, Ladenburg, Baeyer, the Fischers, Moissan, Knorr, LeBel, Ramsay, and the Curies.

The condition of pharmacy in general was vastly different at the close of the century from the picture so graphically drawn by Daniel B.



FORMULARY

FOR THE

PREPARATION AND MODE OF EMPLOYING

SEVERAL

NEW REMEDIES; Geo. [illegible]

NAMELY,

MORPHINE, IODINE, QUININE, CINCHONINE, THE HYDRO-CYANIC ACID, NARCOTINE, STRYCHNINE, NUX VOMICA, EMETINE, ATROPINE, PICRO-TOXINE, BRUCINE, LUPULINE, &c. &c.

WITH

AN INTRODUCTION, AND COPIOUS NOTES.

BY THE LATE

CHARLES THOMAS HADEN, Esq.

Translated from the French of the Third Edition of MAGENDIE'S "*Formulaire.*"

By ROBLEY DUNGLISON, M. D.

Professor of the Institutes and Practice of Medicine, in the University of Virginia; F. R. S. Nancy; F. L. S. Paris; Secretary for Foreign Correspondence to the Medical, and Member of the Hunterian Society of London, &c.

REVISED AND CORRECTED BY A PHYSICIAN OF PHILADELPHIA.

WITH AN APPENDIX.

PHILADELPHIA:

PUBLISHED BY JAMES WEBSTER, AT THE OFFICE OF THE MEDICAL RECORDER, NO. 24, S. EIGHTH ST.

1824.

FIG. 57.—TITLE-PAGE OF MAGENDIE'S *Formulary* (AMERICAN EDITION), 1820. TRANSLATED BY DR. ROBLEY DUNGLISON. NOTE THE LIST OF "NEW REMEDIES." SEE PAGE 457.

Smith in the remarks quoted earlier in this chapter. The introduction of new and convenient dosage forms of medicines had stimulated the development of large-scale manufacturing by a number of forms who relieved the pharmacist of much of his exclusive and distinctively professional work. The growth of the nostrum business and the evils of unrestricted competition, in the United States particularly, had been accompanied by a development of what came to be popularly known to pharmacists as the cut price evil. This led in 1898 to the organization of the National Association of Retail Druggists, which has since that time devoted its attention particularly to protecting the commercial interests of the pharmacist, for the average pharmacist had become more of a merchandizer than had any of his predecessors in centuries past.

In most other countries pharmacy had not yet quite reached this condition, for the educational standards were higher, there was more specific recognition of the services pharmacy is capable of performing, which was evidenced in the establishment of pharmaceutical corps in the military organizations of most of the European countries, and these were developed to a high degree of perfection and efficiency.

The pharmaceutical corps of the United States

Army, which had been instituted in 1776, had been entirely abandoned about fifty years later by act of Congress, the last holder of the title of Apothecary-General of the United States Army being James Cutbush, a prominent pharmacist and chemist during the first two decades of the century.

In summing up the pharmaceutical history of the nineteenth century one is impelled to the conclusion that while as a science and a profession pharmacy had gained tremendously in its possibilities, as an actual practice it had lost much ground because of the comparatively lower level of ability and ideals of its practitioners taken as a group, and this in spite of the fact that much educational progress had been made. Picture, for example, the surroundings and the work of the pharmacist of 1800 as contrasted with the pharmacist of 1900.

The former was responsible for the identification of his own crude drugs, and when they were desired in the comminuted condition, he or his apprentice accomplished the work in the large contusion mortar, which was then the most important piece of store furniture, as it had been for centuries previous, as can be verified by consulting the illustrations of early pharmacies. The pharmacist of the beginning of the century had

never heard of percolation, and his windows and laboratory counters were occupied with great containers filled with macerating tinctures that required agitation every day. The daily dozen was not needed in those days for pharmacy was by no means a sedentary occupation. Most simple chemicals were prepared by himself for there were few manufacturing chemists. The nostrums were few, and there were no manufacturing pharmacists as we know them today.

The pharmacist of that time had no soda fountain, no telephone, no stove for burning anthracite coal, for anthracite did not come into use until about twenty-five years later, and no oil heater, for petroleum was not an important article of commerce until the first successful oil well was drilled in Pennsylvania in 1859. He had no matches, no lamps, such as were later used and known, and of course, no electric lights or other electrical appliances. If he wished to travel a long distance by land he went by stage coach; if by water, the ship was a sailing vessel. He was usually called an apothecary at that time to distinguish him from the wholesaler, who was called the druggist.

In short, the pharmacist of 1801 was a craftsman who was dependent upon his own resources and his own ingenuity for most of his chemicals

and preparations, while his professional descendant, at the end of the same century, possessing more scientific knowledge than his predecessor, had much of his professional work done for him by others and could therefore spare more time to devote to other matters. Reared in the lap of comparative luxury and surrounded by conveniences undreamed of by the earlier members of the craft, the pharmacist of 1900, instead of devoting his spare time to increasing his professional and scientific work, followed the line of least resistance, which is the line of merchandizing.

The most characteristic and permanent literature of pharmacy during the nineteenth century is to be found in the pharmacopœias of the principal nations. Beginning with the French Codex of 1818 and the U.S.P. of 1820, and following down through the successive revisions of these and other national pharmacopœias which appeared up until the end of the century, the degree to which science has replaced empiricism can be traced as definitely as the geologist determines the history of the earth from the successive rock strata deposited during the time of their formation.

During this period there were eight editions of the Swedish Pharmacopœia, seven of the Austrian, six each of the Danish and Spanish, five of the French, four of the German, three

each of the British, Netherlands, Norwegian and Swiss, and two each of the Belgian, Italian, and Japanese. All of these pharmacopœias have appeared in at least one revision during the twentieth century and several have been revised twice since 1900.

In 1888 the American Pharmaceutical Association issued a book of recipes for unofficial substances which was called the *National Formulary.* This was revised in 1896, and again in 1906 when it had become coequal in authority with the *United States Pharmacopœia.* It has been revised twice since then.

Several Dispensatories, or commentaries upon the Pharmacopœia have appeared in America, among which the more important have been the *United States Dispensatory,* the *American Dispensatory* and the *National Dispensatory.* The *United States Dispensatory* is the only one of these that has been revised since 1920. It is now in its twenty-first edition. In Great Britain the principal commentaries are *Squire's Companion, Martindale's Extra Pharmacopœia* and the *British Pharmaceutical Codex.* In France the corresponding work is Dorvault's *L'Officine* and in Germany and continental Europe generally *Hager's Commentary.*

Several homeopathic pharmacopœias have

also appeared, but homeopathic pharmacy in general is of comparatively little importance.

The practice of pharmacy in the various other countries of the world developed along more distinctly professional lines, as a rule, than was the case in America. We can do no better in this connection than quote from a portion of the masterly survey of pharmacy in Europe by Dr. Henry L. Taylor of the New York Department of Education, published in 1910 in the *Midland Druggist.*

In Austria, where pharmacy was a restricted profession, the requirements for admission to practice were determined by decrees of the ministers of education and the interior. Provisions were made for apprenticeship, assistants and master pharmacists. The guilds of pharmacists were usually corporate bodies of high professional status. All pharmacists were required to hold membership in their professional organizations. The preliminary education required of an apprentice was six years of gymnasium work. (The gymnasium was equivalent to our high school.) One who could show eight years of gymnasium work had the apprenticeship time of three years reduced by one year.

The apprenticeship term was followed by an examination held by either apothecaries alone

or in the presence of a Royal Health Officer, and in the shop of one of the examiners. The examination subjects were physics, botany, pharmaceutical supplies, chemistry, posology, pharmaceutical technique, the arrangement of the shop and laboratory, and pharmaceutical laws and ordinances. After passing the examination successfully the apprentice became an assistant. To become a master pharmacist one was required to be a graduate of a two-year university course in pharmacy, which, however, was much more comprehensive than a two-year course in an American college, for they had summer semesters as well as winter semesters and the vacation periods were very brief. The candidate for the degree of Ph.M., the principal pharmaceutical degree, was required to pass three preliminary examinations and a final (*rigorosum*). The examinations were largely oral and were open to the public, as a rule, although at the discretion of the dean of the presiding faculty, philosophical or medical, admission might be restricted to apothecaries or pharmacy students.

Practical examinations were held in the last month of the second year of the course. Three successive failures of an applicant for examination forever debarred him from obtaining a pharmacy degree at any university in the Empire.

In order to obtain a license to carry on a public pharmacy the holder of the diploma of the degree of Ph.M. was required to show that he had been employed for five years as an assistant pharmacist, after receiving such diploma, of which at least three years must have been spent in a public apothecary shop.

The rigorous conditions in Austria were practically duplicated in Belgium, Denmark, Finland, England, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. Can any one wonder why pharmacy in America has been looked upon with more or less disdain, during the nineteenth century by European educators, when the qualifications of the practitioners here and in Europe are compared?

Fig. 58.—Photograph of William Procter, Jr., the "Father of American Pharmacy."
See page 490.

CHAPTER XI

THE PRESENT TWENTIETH CENTURY WHOSE HISTORY CANNOT YET BE WRITTEN

WE ARE constantly in the midst of history in the making. With our perspective distorted by too close proximity we are usually unable to differentiate between what is historically important and what is not. With this in mind the brief review of such progress as has been made during the first quarter of the new century will be given without especial emphasis upon any particular phase, or expression of opinion as regards future progress. The historian usually makes a poor prophet, because in dealing with historical developments, and causes and effects, unknown factors are often present which upset all calculations.

The twentieth century opened in the United States with the Semi-centennial meeting of the American Pharmaceutical Association.

For a half century the *Proceedings* of this Association had been the repository of the records of American pharmaceutical progress, while the *Transactions of the British Pharmaceutical Conference* and the *Berichte der Deutschen Chemis-*

chen Pharmaceutischen Gesellschaft kept pace in their respective countries.

At this Jubilee meeting of the American Pharmaceutical Association Dr. Friedrich W. Hoffmann, the eminent pharmaceutical journalist and historian presented a review of American pharmaceutical progress entitled *A Retrospect of American Pharmacy* (see illustration No. 59 opposite p. 528).

During the nineteenth century a distinctive current literature had developed in pharmacy, exclusively devoted to the interests of the profession. Some of these journals were and are of a professional type, others of a commercial character; still others divided their interest so that both fields were covered. Of the more important journals of the professional type are the following:

The *American Journal of Pharmacy,* established in 1825 by the Philadelphia College of Pharmacy. This is the next to the oldest pharmaceutical journal in the world, the oldest being the *Journal de Pharmacie et de Chemie,* which was founded in Paris in 1809 under the name of *Bulletin de Pharmacie et de Sciences accessoires.*

Annalen der Pharmacie; Berichte der Deutschen Pharmaceutischen Gesellschaft; Journal de Pharmacie d'Anvers; Journal de Pharmacie de Liege; Journal of the American

Pharmaceutical Association (founded 1912); *Neues Repertorium für Pharmacie; Pharmaceutical Journal and Transactions; Pharmaceutical Archives; Pharmaceutische Centralblatt; Pharmaceutische Centralhalle; Pharmaceutische Rundschau; Pharmaceutical Review; Pharmaceutische Zeitung; Schweizische Wochenschrift für Pharmacie; Zeitschrift des Allgemeines Oesterreichischen Apotheken Verein.*

Journals of the composite and of the commercial type are the following:

American Druggist; Apotheker Zeitung; Australasian Journal of Pharmacy; British and Colonial Druggist; Bulletin of Pharmacy; Chemist and Druggist; Canadian Druggist; Canadian Pharmaceutical Journal; Druggists Circular; Drug Topics; Journal of the National Association of Retail Druggists; Merck's Report; Merck's Bulletin; Montreal Pharmaceutical Journal; National Druggist; Pacific Drug Review; Pharmaceutical Era; Pharmaceutical Record; Practical Druggist; Rocky Mountain Druggist; Southern Pharmaceutical Journal; Western Druggist.

The three great factors which are operating to influence pharmacy at present are along the respective lines of organization, legislation, and education. In connection with the first of these the tendency has been toward strengthening and stabilization. All of the associations, national and state, are much stronger numerically than they

were at the beginning of the century. The National Association of Retail Druggists has fully justified its existence, and has an efficient full-time secretary, Mr. Samuel C. Henry, whose headquarters are in Chicago. This organization has zealously labored to protect the commercial and legislative interests of the pharmacist, and deserves the support of every practicing member of the profession. Active membership in this organization is limited to retail pharmacists.

The American Pharmaceutical Association, which is more liberal in its requirements for membership, has recently made some important changes in its constitution and by-laws, and now has a full-time secretary, Dr. E. F. Kelly. The present offices of the Association are at Baltimore, but a large sum of money has been collected for the establishment of a permanent Headquarters Building, which will be built within the next few years at a location to be determined by the vote of the members of the Association. This organization has devoted its energies more particularly to scientific and educational work, and deserves also the unqualified support of every individual who is interested in any phase of pharmacy. These two great national organizations are not rivals,

for their work does not overlap, but each is supplementary to the other.

The fusion of these two organizations has been suggested by members high in the councils of both bodies. A coördination of work and interest and a common headquarters for these two organizations would undoubtedly be a great benefit to pharmacy. If every pharmacist were a member of both organizations, as he should be, the fusion would take place naturally and inevitably. As long, however, as there are pharmacists who are interested only in merchandizing and who are not willing to even join the association which particularly looks after the professional progress that gives pharmacy its distinctiveness and its name, and as long as there are thousands of pharmacists who belong to no association, just so long will this fusion be deferred.

In 1922 the American Pharmaceutical Association adopted a new code of ethics, the original code no longer answering the needs of modern developments in pharmacy. This revised code has since been adopted by the National Association of Retail Druggists, the Canadian Pharmaceutical Association, and by the pharmaceutical organizations of several South American republics, so it may be considered as representing

American pharmacy. It is here reproduced in full:

CODE OF ETHICS OF THE AMERICAN PHARMACEUTICAL ASSOCIATION [1]

CHAPTER I

The Duties of the Pharmacist in Connection with His Services to the Public

Pharmacy has for its primary object the service which it can render to the public in safeguarding the handling, sale, compounding and dispensing of medicinal substances.

The practice of pharmacy demands knowledge, skill and integrity on the part of those engaged in it. Pharmacists are required to pass certain educational tests in order to qualify under the laws of our states. The states thus restrict the practice of pharmacy to those persons who by reason of special training and qualifications are able to qualify under regulatory requirements and grant to them privileges necessarily denied to others.

In return the states expect the Pharmacist to recognize his responsibility to the community and to fulfil his professional obligations honorably and with due regard for the physical and moral well-being of society.

The Pharmacist should uphold the approved legal standards of the United States Pharmacopœia and the National Formulary for articles which are official in either of these works, and should, as far as possible, encourage the use of these official drugs and preparations and discourage the use of objectionable nostrums.[2] He should sell and dis-

[1] Adopted August 17, 1922.

[2] An objectionable nostrum is one which does not meet the requirements of the definition of the Commission on Proprietary Medicines of the American Pharmaceutical Association.

pense only drugs of the best quality for medicinal use and for filling prescriptions.

He should neither buy, sell nor use substandard drugs for uses which are in any way connected with medicinal purposes.

The Pharmacist should be properly remunerated by the public for his knowledge and skill when used in its behalf in compounding prescriptions, and his fee for such professional work should take into account the time consumed and the great responsibility involved as well as the cost of the ingredients.

The Pharmacist should not sell or dispense powerful drugs and poisons to persons not properly qualified to administer or use them, and should use every proper precaution to safeguard the public from poisons and from all habit-forming medicines.

The Pharmacist, being legally entrusted with the dispensing and sale of narcotic drugs and alcoholic liquors, should merit this responsibility by upholding and conforming to the laws and regulations governing the distribution of these substances.

The Pharmacist should seek to enlist and merit the confidence of his patrons and when this confidence is won it should be jealously guarded and never abused by extortion or misrepresentation or in any other manner.

The Pharmacist should consider the knowledge which he gains of the ailments of his patrons and their confidences regarding these matters, as entrusted to his honor, and he should never divulge such facts unless compelled to do so by law.

The Pharmacist should hold the health and safety of his patrons to be of first consideration; he should make no

attempt to prescribe or treat diseases or strive to sell drugs or remedies of any kind simply for the sake of profit.

He should keep his pharmacy clean, neat and sanitary in all its departments and should be well supplied with accurate measuring and weighing devices and other suitable apparatus for the proper performance of his professional duties.

It is considered inimical to public welfare for the Pharmacist to have any clandestine arrangement with any physician in which fees are divided or in which secret prescriptions are concerned.

The Pharmacist should primarily be a good citizen, and should uphold and defend the laws of the state and nation. He should inform himself concerning the laws, particularly those relating to food and drug adulteration and those pertaining to health and sanitation and should always be ready to coöperate with the proper authorities having charge of the enforcement of the laws.

The Pharmacist should be willing to join any constructive effort to promote the public welfare and he should regulate his public and private conduct and deeds so as to entitle him to the respect and confidence of the community in which he practices.

CHAPTER II

The Duties of the Pharmacist in His Relations to the Physician

The Pharmacist even when urgently requested to do so should always refuse to prescribe or attempt diagnoses. He should, under such circumstances, refer applicants for medical aid to a reputable legally qualified physician. In cases of extreme emergency as in accident or sudden illness

on the street in which persons are brought to him pending the arrival of a physician such prompt action should be taken to prevent suffering as is indicated by humanitarian impulses and guided by scientific knowledge and common-sense.

The Pharmacist should not, under any circumstances, substitute one article for another, or one make of an article for another in a prescription, without the consent of the physician who wrote it. No change should be made in a physician's prescription except such as is essentially warranted by correct pharmaceutical procedure, nor any that will interfere with the obvious intent of the prescriber, as regards therapeutic action.

He should follow the physician's directions explicitly in the matter of refilling prescriptions, copying the formula upon the label or giving a copy of the prescription to the patient. He should not add any extra directions or caution or poison labels without due regard for the wishes of the prescriber, providing the safety of the patient, is not jeopardized.

Whenever there is doubt as to the interpretation of the physician's prescription or directions, he should invariably confer with the physician in order to avoid a possible mistake or an unpleasant situation.

He should never discuss the therapeutic effect of a physician's prescription with a patron nor disclose details of composition which the physician has withheld, suggesting to the patient that such details can be properly discussed with the prescriber only.

Where an obvious error or omission in a prescription is detected by the Pharmacist, he should protect the interests of his patron and also the reputation of the physician by

conferring confidentially upon the subject, using the utmost caution and delicacy in handling such an important matter.

CHAPTER III

The Duties of Pharmacists to Each Other and to the Profession at Large

The Pharmacist should strive to perfect and enlarge his professional knowledge. He should contribute his share toward the scientific progress of his profession and encourage and participate in research, investigation and study.

He should associate himself with pharmaceutical organizations whose aims are compatible with this code of ethics and to whose membership he may be eligible. He should contribute his share of time, energy and expense to carry on the work of these organizations and promote their welfare. He should keep himself informed upon professional matters by reading current pharmaceutical and medical literature.

He should perform no act, nor should he be a party to any transaction, which will bring discredit to himself or to his profession or in any way bring criticism upon it, nor should he unwarrantedly criticize a fellow Pharmacist or do anything to diminish the trust reposed in the practitioners of pharmacy.

The Pharmacist should expose any corrupt or dishonest conduct of any member of his profession which comes to his certain knowledge, through those accredited processes provided by the civil laws or the rules and regulations of pharmaceutical organizations, and he should aid in driving the unworthy out of the calling.

He should not accept agencies for objectionable nos-

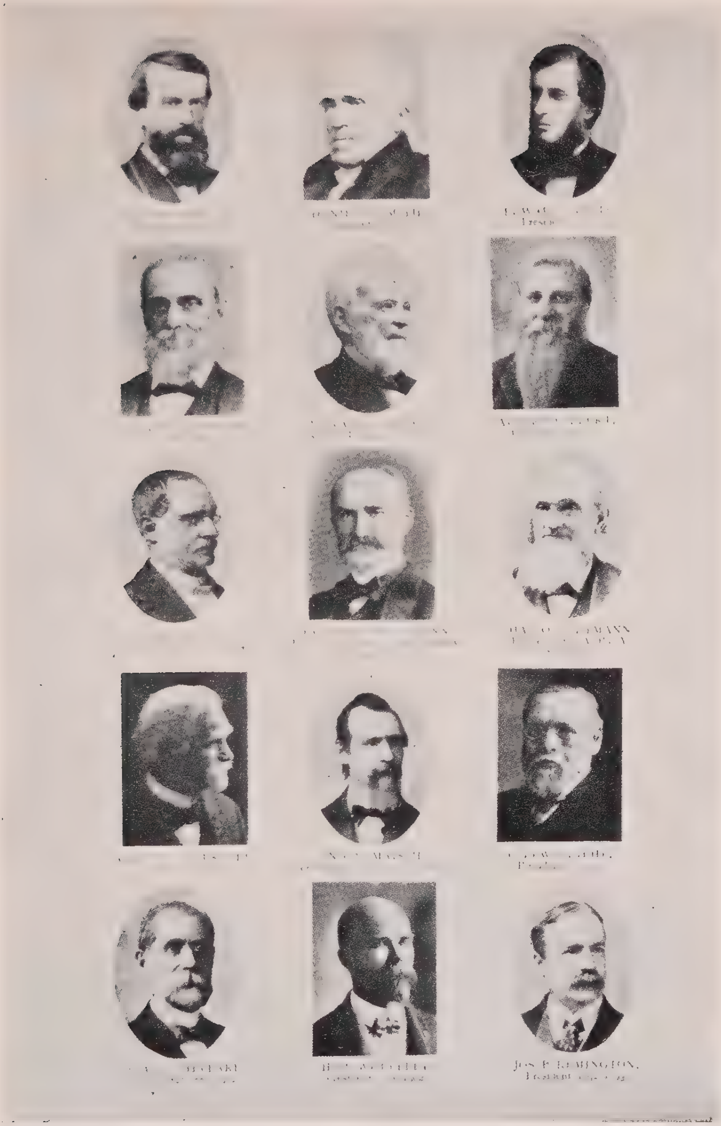


Fig. 59.—Photographs of representative American pharmacists of the nineteenth century, as selected by Dr. Friedrich Hoffmann in 1902, in connection with his retrospect of American pharmacy. See page 520.

trums nor allow his name to be used in connection with advertisements or correspondence for furthering their sale.

He should courteously aid a fellow Pharmacist who may request advice or professional information or who, in an emergency, needs supplies.

He should not aid any person to evade legal requirements regarding character, time or practical experience by carelessly or improperly endorsing or approving statements relating thereto.

He should not imitate the labels of his competitors nor take any other unfair advantage of merited professional or commercial success. When a bottle or package of a medicine is brought to him to be refilled, he should remove all other labels and place his own thereon unless the patron requests otherwise.

He should not fill orders which come to him by mistake, being originally intended for a competitor.

He should deal fairly with manufacturers and wholesale druggists from whom he purchases his supplies; all goods received in error or excess and all undercharges should be as promptly reported as are shortages and overcharges.

He should earnestly strive to follow all proper trade regulations and rules, promptly meet all obligations and closely adhere to all contracts and agreements.

The State associations have also increased in numbers and strength and some of them are established in permanent headquarters and have full time secretaries to look after the interests of the members throughout the year. However, in spite of all the progress that has been made and the efforts that are constantly exerted to add to the

membership of these associations, less than ten per cent. of the pharmacists in the United States belong to all of their pharmaceutical organizations, local, State and National.

In other countries the pharmaceutical organizations are given more general support than in the United States. In Great Britain the principal association, the Pharmaceutical Society of Great Britain, carries on educational work and conducts the examinations for registration. In Australia and New Zealand trades unionism has secured a hold on pharmacy, and hours of opening for business, as well as the time during which employees are permitted to work, are subject to regulation.

An International Pharmaceutical Federation is now in the seventh year of its existence, with headquarters at the Hague. The efforts of this organization are especially directed toward promoting uniformity in standardization and nomenclature. The pioneer work in this direction, particularly in connection with pharmacopœial revision was accomplished, not by an association, using that word in its ordinary sense, but by an organized body composed of delegates from various countries, called the *Conference Internationale pour l'Unification de la Formule des Medicaments Heroiques* (The International

Conference for the Unification of Formulas for Powerful Remedies). The name is usually shortened to *Brussels Conference,* for its first meeting was held in Brussels in 1902. The suggestions promulgated by this body were adopted, for the most part, by pharmacopœial revision committees all over the world, and the official substances whose standards have been brought into agreement with the provision of the Conference are designated by the initials "P. I.," meaning "Protocol International." The latest meeting of the Conference was in the autumn of 1925.

Legislation affecting pharmacy has been particularly rife during the opening years of the twentieth century. The first important enactment was the passage of the Food and Drugs Act in 1906, which, while its provisions only nominally affected products entering interstate commerce, had an influence upon pharmacy through the numerous State laws which were passed during the next few years following the passage of the national act. This legislation made the *United States Pharmacopœia* and the *National Formulary* essentially equivalent to the "law of the land," and placed new responsibilities upon the revision committees of these standard pharmaceutical works.

Another piece of national legislation affecting pharmacists was the Harrison Anti-narcotic Act, passed in 1914. This law regulates the interstate traffic in opium and coca and all of their compounds, derivatives, preparations, etc. Its registration provisions essentially give it police power in the States themselves. It is to the credit of the profession of pharmacy that although for years there had been few restrictions on the sale of narcotics, and in spite of the fact that opium had been used and prescribed for centuries, almost as freely as a household remedy, there has been a negligible proportion of violations of the law by pharmacists, for they had seen the evils of the traffic and had largely corrected the abuses by voluntary action, so far as the profession of pharmacy was concerned, and had welcomed such legislation and aided in its passage.

State legislation particularly affecting pharmacy will be further discussed under the subject of education, but mention must be made of the "drugstore ownership laws" which have been passed in New York and in one or two other States restricting the ownership of a pharmacy to one who is registered as a pharmacist under the laws of the State.

The most important legislation affecting pharmacy ever passed in the United States was

the Prohibition Amendment, supplemented by specific legislation known as the Volstead Act, and also as the National Prohibition Act. This legislation has worked a grave injury to pharmacy in several ways. Entirely apart from the legal aspects of the situation, upon which all true pharmacists are united in the belief that the law should be upheld, the injury resulting has been due first to the fact that the formalities and restrictions connected with the legitimate use of alcohol are so discouraging and so onerous that many pharmacists are purchasing nearly all of their pharmaceutical preparations instead of making them for themselves. Then, too, the tax exemptions on alcohol used in certain preparations, when made on the large scale and under bond, make it possible for a manufacturer to offer certain commonly used pharmaceutical preparations like tincture of iodine and soap liniment, at a price far below that for which they can be made by the pharmacist himself. Coming, as it did, at a time when many pharmacists needed little urging to throw overboard the small amount of laboratory manufacturing that they were doing, it certainly gave professional pharmacy a solar plexus blow from which it will take a long time to recover, if it ever does.

Also the advent of national prohibition

attracted to the calling a large number of pseudo-pharmacists, some of whom were formerly liquor dealers, and while the number is not great, a stigma rests in a measure upon the entire profession, just as it rests also in a measure upon the profession of medicine, because some physicians will write liquor prescriptions gratis for their friends or for patients for a fee, or even sell their prescription blanks for illegal use. Medicine and pharmacy have both suffered from the temptations which prohibition legislation has thrown in the way of the weaker members of the professions.

In education the first notable advance was made in the passage of legislation, during the first decade of the century, necessitating graduation from a recognized college of pharmacy as a prerequisite for registration. An organization of teachers in schools of pharmacy was formed in 1900, which was at first called the *American Conference of Pharmaceutical Faculties.* The name was later changed to the *American Association of Colleges of Pharmacy.* The influence of this organization, the majority of whose members are connected with pharmacy schools which are departments of universities, has been uniformly and continuously exerted in the interest of increased entrance requirements and the lengthening of the course in pharmacy.

Phenomenal progress has been made in these directions within the past ten years, the entrance requirements having been advanced from " none " to " four years of high school," and the minimum course in pharmacy from two years to three. Several schools have recently voluntarily increased the minimum course to four years.

The designation used in America for more than one hundred years in connection with the diploma of the two-year course in pharmacy is Graduate in Pharmacy, Ph. G. This is really not a degree at all, and has no status in academic circles. Other designations are, for different courses: Pharmaceutical Chemist, Ph. C.; Bachelor in Pharmacy, Phar. B.; Master in Pharmacy, Ph. M.; Bachelor of Science in Pharmacy, B. Sc. in Phar.; and Doctor of Pharmacy, Phar. D.

By resolution of the American Association of Colleges of Pharmacy the baccalaureate degree can be given only for a four-year course, and the doctorate degree for a seven-year course. Both the doctor's and the master's degrees are sometimes given as honorary degrees.

Concurrent with the development of education in the profession has come an integration and improvement in the matter of examinations for registration. The progress here has been largely due to the influence of an organization

called the National Association of Boards of Pharmacy, which has headquarters in Chicago and a full-time secretary, Dr. H. C. Christensen. Through the work of this organization reciprocity agreements are now in effect between many of the States.

The obvious tendency toward commercialism on the part of many practitioners of pharmacy has greatly aggravated the evil which arose in the previous century, called price cutting. Efforts are at present being made to combat this condition by what is called "price standardization legislation," which will regulate the prices of nationally advertised goods. This problem has already been solved in Great Britain by the forming of an association called the Proprietary Articles Trade Association (P.A.T.A.), which was the result of the lifework of an earnest and capable English pharmacist, Sir William S. Glyn-Jones, who is now trying to work out the same plan in Canada. This plan cannot be applied in the United States because of certain provisions in the Sherman Anti-Trust law. Many attempts have been made by associations and by individual firms in the United States to curb the price-cutting evil, which is so demoralizing to the profession, but no plan has yet been found which is satisfactory in all respects, and

national legislation is the final hope of those who are desirous of seeing this problem solved.

In this period, when conflicting ideals and interests have served to confuse the public as to the real aims and ideals of pharmacy, several suggestive slogans have appeared and have found widespread use. One of these is "Try the drugstore first," a purely commercial slogan. The other is "Your druggist is more than a merchant," an obviously professional slogan.

Another idea which is meeting with enthusiastic success and which has been taken up in Canada and also in far-away Australia, is the adoption of a national week called "Pharmacy Week," during which every pharmacist is expected to centralize his energies upon showing the public the wide scope and importance of the pharmacist's professional work. This idea was first suggested by Robert J. Ruth of Philadelphia, while Chairman of the Section on Practical Pharmacy and Dispensing of the American Pharmaceutical Association, at a meeting held in Buffalo in 1924.

The special field of research in pharmacy is ably handled by an organization called the National Conference on Pharmaceutical Research, which under the leadership of Dr. H. V. Arny of New York has collected statistics, kept

in touch with research workers along pharmaceutical lines, and stimulated scientific work in pharmacy in many ways.

Pharmacopœial research problems are also being attacked systematically in advance of the election of a new revision committee, according to a plan now being put into effect under the direction of Professor E. Fullerton Cook, Chairman of the Committee of Revision of the United States Pharmacopœia.

In 1919 the New York Branch of the American Pharmaceutical Association instituted the first honorary award for distinguished services in pharmacy in America. This is called the Remington Honor Medal in commemoration of Professor Joseph P. Remington, one of America's most illustrious pharmacists, who had received many honors at home and abroad, and who had been Chairman of the Revision Committee of the U. S. Pharmacopœia for two successive decades. The recipients of this honor are chosen by the majority vote of the living ex-presidents of the American Pharmaceutical Association.

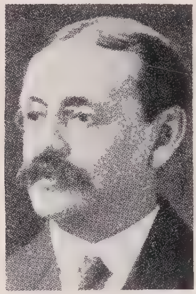
Those who have received this honor up to the present time are Dr. James H. Beal, Dr. John Uri Lloyd, Dr. H. V. Arny, Mr. George M. Beringer, Dr. H. H. Rusby, Dr. Henry M.

Dr. James H. Beal

Dr. John Uri Lloyd

Prof J. P. Remington

Dr. H. V. Arny



Mr. G. M. Beringer

Dr. H. H. Rusby

Dr. H. M. Whelpley

Dr. H. A. B. Dunning

Fig. 60.—A group of famous twentieth century pharmacists. Those to whom the Remington medal has been awarded from 1919 to 1926, inclusive. See page 538.

Whelpley, and Prof. H. A. B. Dunning. (See illustration No. 60, opposite page 538.)

At the Sesqui-centennial Exposition, which was held in Philadelphia in 1926, pharmacy was given a prominent location in the Palace of Education. An exhibit was made of the progress of pharmacy during the past one hundred and fifty years. This exhibit was installed under the direction of a special committee of Philadelphia pharmacists, who followed plans which had been approved by the various national pharmaceutical organizations. (See illustrations Nos. 61, 62, 63 and 64, opposite pages 550, 558, 570 and 578.)

The general progress in science during the twentieth century has been remarkable. Notable workers in the several fields have been Osborne and Hrdlika in anthropology, Ehrlich in biology, Dr. William A. Gorgas and Walter Reed in medicine; Crookes, Thomson, and Millikan in physics; Steinmetz in electricity; Richards, Arrhenius, Bragg, Aston, and Langmuir in chemistry. We must not forget Dr. Frederick B. Power, pharmacy's most prominent research worker nor Prof. W. O. A. Tschirsch, of Bern, Switzerland, who was recently honored by pharmacists from all over the world, on his seventieth birthday.

During this quarter of a century radio has

annihilated space; Newton's laws have been amended and some fear that they will be repealed; the transmutation of the elements has been effected, although not for profit; the silent drama has become a factor in our civilization; the airplane and dirigible have become so commonplace that it takes a fleet of them to awaken interest in the average pedestrian; the telephone, which was a toy fifty years ago and a business necessity for the affluent twenty-five years ago has become one of our most indispensable modern inconveniences.

Fashions in remedies have changed quite as marvelously in the past few decades. The modern physician frequently is called upon to administer one of the "biologicals," which differ from the remedies of Serapion principally in the fact that the modern products are prepared under sanitary conditions and according to recently discovered scientific principles. The sera and antitoxins of modern pharmacy are triumphs of biological and therapeutic research.

Biologicals, however, are not the sole remedial agents used today. Many physicians still write old-fashioned prescriptions for old-fashioned drugs and chemicals, and pharmacists are needed to fill these prescriptions as well as to dispense the

modern therapeutic agents, many of which require skill and care for their preservation.

The doctrine of signatures of the seventeenth century was an extreme swing of the pendulum in one direction. The so-called therapeutic nihilism of a few decades ago was a return swing in the opposite direction. The true course of medicine and pharmacy lies in the middle ground between these extremes. Perhaps they will go hand in hand some day in search—not of the fountain of youth—but of the best way to keep mankind from becoming ill, and when ill, to find the most expeditious and pleasant method of restoring health. Pharmacy shares this responsibility with medicine and chemistry, and from the time of the earliest dynasty of Egyptian kings to the present time, the pharmacist has been the custodian of medicinal substances and the one who identifies, selects, preserves, combines, analyzes and standardizes them.

Every calling, trade, art, profession, has a history. The influence of the past upon the present is in direct proportion to the wealth of tradition and of history that has been handed down through successive generations. Progress is frequently measured in terms of respect for those who have preceded us and who have left us landmarks to guide our way. Let us not be vain-

glorious in the pride of our present achievements. Let us not look with disdain or ridicule upon the ignorance and credulity of much of the past. Let us rather keep in mind a quotation from Paris' *Pharmacologia* of almost exactly a century ago:

> What pledge can be afforded that the boasted remedies of the present day will not, like their predecessors, fall into disrepute, and in their turn serve only as humiliating memorials of the credulity and infatuation of the physicians who commended and prescribed them?

BIBLIOGRAPHICAL NOTES FOR COLLATERAL READING AND FOR REFERENCE

This bibliography is not intended to be complete. It is a fairly representative list of titles, however, which with one or two exceptions are from books in the author's own library and with which, therefore, he has had time to become rather well acquainted, bearing in mind Bacon's epigrammatic advice about books.

The arrangement of the bibliographical references is according to subjects, placing pharmacy first.

A casual survey of the groups and of the individual titles will be convincing as to the wealth of literary material stored up for pharmaceutical historians, particularly during the seventeenth century.

In addition to this bibliography of specific titles many general works of reference were in constant use during the time when this material was assembled for publication.

PHARMACY, HISTORICAL

1853 *Histoire des Apothecaires,* A. Phillippe, Paris.
1871 *Storia della Farmacia e dei Farmacisti,* F. Kernst, Naples.

1889 *Pictorial History of Ancient Pharmacy and Medicine,* Herman Peters (Wm. Netter, Chicago).

1900 *Histoire de la Pharmacie,* L. Andre-Pontier, Paris.

1904 *Geschichte der Pharmazie,* Hermann Schelenz, Berlin.

1907 *Das Apothekenwesen,* J. Berendes, Stuttgart.

1907 *History and Romance of Alchemy and Pharmacy,* C. J. S. Thompson, London.

1910 *Chronicles of Pharmacy,* A. C. Wootton.

1921 *The First Century of the Philadelphia College of Pharmacy,* Philadelphia.

1924 *Romance of the Apothecaries' Garden at Chelsea,* F. Dawtrey Drewitt, London.

1925 *Illustrierter Apotheker Kalender,* Süddeutsche Apotheker Zeitung.

1926 *Illustrierter Apotheker Kalender,* Süddeutsche Apotheker Zeitung.

PHARMACY, GENERAL

1670 *La Pharmacie Theorique,* N. Chesneau (Quercetanus), Paris, 2d edition.

1674 *Pharmaceuticæ Rationalis,* Th. Willis, Oxford.

1712 *Synopsis Pharmaciæ,* Jos. Conrad Barchusen, Lyons, 3d edition.

1719 *Les Secrets et les Fraudes de la Chymie et de la Pharmacie,* The Hague.

1784 *Elements de Pharmacie Theorique et Pratique,* 5th edition, A. Baumé, Paris.

1825 *Pharmacologia,* John Ayrton Paris, London, 6th edition.

1831 *Pharmacologia,* John Ayrton Paris, New York, 4th American edition.

PHARMACOPŒIAS AND BOOKS CONTAINING PHARMACEUTICAL RECIPES

1561 *Dispensatorium,* Valerius Cordus, Lyons.

1562 *Mesue Græcorum ac Arabum Opera Omnia,* Venice. (Contains works of Mesue, de Honestis, Peter of Abano, Francis de Piedmont, Nicholas Præpositus, John de St. Amando, Gentilis Fuliginatus, Albucasis, Saladin, and Alkindus, with comments by Silvius and Monardes.)

1577 *Antidotarium Speciale,* J. J. Wecker, Basle (2 vols.).

1599 *Philonum Pharmaceuticum, de Taranta,* Johann Hartmann, Frankfort.

1608 *Antidotarium Generale et Speciale,* J. J. Wecker, Venice.

1619 *La Farmacopœa Riformata,* Quercetanus, Venice.

1636 *Antidotarium Bononien,* Bologna.

1640 *Thesaurus Armamentarium,* Adrian Mynsicht, Lyons.

1642 *Antidotarium Generale et Speciale,* J. J. Wecker, Basil. (A later edition than the one previously mentioned.)

1643 *Basilica Chymica,* Oswald Crollius, Geneva.

1643 *Pharmacopœia Spagirica,* Petrus Poterius, Bologna.

1651 *Pharmacopœia Galeno-Chemica Catholica,* Quercetanus, Venice.

1656 *Pharmacopœia Medico-Chymica,* Johann Schroeder, Lyons.

1667 *Teatro Farmaceutico,* Soggietti, Venice.

1667 *Animadversiones in Pharmacopœianam Augustanam,* Johann Zwelfer, Nuremburg.

1668 *Pharmacopœia Regia,* Johann Zwelfer, Nuremburg.

1670 *The English Physician or the Druggists Shop Opened,* William Salmon, London.

1673 *Pharmacopœia Augustana Restituta,* Augsburg.

1674 *Pharmacopœia Lugdunensis, Reformata,* Lyons.

1675 *Clavis Pharmaceutica, Schroederiana,* Halle.

1677 *Teatro Farmaceutico,* Giuseppe Donzelli, Rome.

1678 *Antidotario Romano,* Venice.

1684 *Pharmacopœia Regia Galenica,* Moses Charas, Geneva.

1684 *Pharmacopœia Regia Chymica,* Moses Charas, Geneva.

1687 *Pharmacopœia Schroedero-Hoffmanniana,* Geneva.

1693 *Medicinal Experiments or a Collection of Choice and Safe Remedies,* Hon. Robt. Boyle, London.

1696 *Ricettario Fiorentino,* Florence.

1696 *Thesaurus Armamentarium Medico-Chymicum,* Adrian Mynsicht, Venice.

1698 *Le Pharmacopee Raisonée de Schroeder* (2 vols.), M. Ettmuller, Lyons.

1698 *Les Formules de Medicine,* Michel Ettmuller, Lyons.

1704 *Teatro Farmaceutico Dogmatico et Spagirico,* Giuseppe Donzelli, Venice.

1720 *Pharmacopœia Universale,* Nicholas Lemery, Venice.

1728 *English Dispensatory,* John Quincy, London.

1753 *Pharmacopœia Edinburghensis,* London.

1771 *Pharmacopœia Chirurgicale, Theorique et Pratique,* Paris.

1789 *Le Manuel des Dames de Charité,* Rouen.

1824 *Formulary for the Preparation and Employing Several New Remedies,* Magendie, Translated by Dunglison, Phila.

1846 *Pharmacopœia Universalis* (2 vols.), Weimar.

CHEMISTRY, HISTORICAL AND BIOGRAPHICAL

1843 *Histoire de la Chemie,* Ferdinand Hoefer (2 vols.), Paris.

1869 *History of Chemical Theory,* Ad Wurtz.

1869 *Beitrage zur Geschichte der Chemie,* Hermann Kopp, Brunswick.

1875 *Ansichten Uber die Aufgabe der Chemie,* Hermann Kopp, Brunswick.

1888 *Lives of the Alchemystical Philosophers,* A. E. Waite, London.

1892 *Histoire de la Physique et de la Chimie,* Ferdinand Hoefer, Paris.

1893 *The Alchemistical Writings of Edward Kelly,* London.

1894 *The New Pearl of Great Price,* London.

1903 *The Story of Alchemy,* M. Pattison Muir, New York.

1909 *History of Chemistry* (2 vols.), Sir Edward Thorpe, New York.

1909 *John Dee,* Charlotte F. Smith, London.

1910 *Cagliostro,* W. R. H. Trowbridge, London.

1910 *Life of Paracelsus,* Franz Hartmann, London.

1910 *Alchemy Ancient and Modern,* H. Stanley Redgrove, Philadelphia.

1911 *A Concise History of Chemistry,* T. P. Hilditch, New York.

1913 *A History of Chemistry,* James Campbell Brown, Philadelphia.

1918 *A History of Chemistry,* F. J. Moore, New York.

1919 *Chemistry in Old Philadelphia,* Edgar F. Smith, Philadelphia.

1919 *Chemistry in America,* Edgar F. Smith, Philadelphia.

1920 *Eminent Chemists of Our Time,* Benjamin Harrow, New York.

1920 *Paracelsus,* John M. Stillman, Chicago.

1920 *Priestley in America,* Edgar F. Smith, Philadelphia.

1921 *Famous Chemists,* Wm. Tilden, N. Y.

1921 *Alchemy, Its Science and Romance,* J. E. Mercer, London.

1924 *The Story of Early Chemistry,* John M. Stillman, New York.

1924 *A Short History of Chemistry,* Rose Stern, London.

1925 *Three Centuries of Chemistry,* Irvine Masson, London.

1925 *Chemistry to the Time of Dalton,* E. J. Holmyard, London.

Splendor Solis, Reprint, London.

Alembic Club Reprints, London.

CHEMISTRY, MISCELLANEOUS AND APPLIED

1570 *Secreti Diversi et Miraculosi,* Fallopius, Venice.

1592 *Secreta Secretorum,* Raymond Lully, Cologne.

1611 *De Occulta Philosophia,* Basil Valentine (Johann Thölde), Hesse.

1635 *Praxis Chymiatra,* Johann Hartmann, Geneva.

1647 *Praxis Chymiatra,* Johann Hartmann, Geneva. (Another edition.)

1651 *Furninovi Philosophici,* Johann Rudolph Glauber, Amsterdam.

1659 *Tractatus de Natura Salium,* Johann Rudolph Glauber, Amsterdam.

1674 *Guida alla Chimica,* Carlo Lancillotti, Venice.

1686 *A Course of Chemistry,* Nicholas Lemery, London.

1697 *The Philosophic Works of Hermes Trismegistus, Kalid Persicus, Geber, Nicholas Flamel, Roger Bacon, and George Ripley,* W. A. Salmon, London.

1724 *Triumph-Wagen des Antimonii,* Basil Valentine (Kerkringi), Nuremburg.
1773 *Chymiæ Experimentale et Raisonée* (3 vols.), Antoine Baumé, Paris.
1786 *Manual of Chemistry,* Antoine Baumé, London.
1786 *Chemical Essays,* Charles William Scheele, London.
1794 *Experimental Philosophy, particularly including Chemistry,* Joseph Priestley, Dublin.
1796 *Philosophie Chemique,* A. F. Fourcroy, Paris.
1818 *Chemical Amusement,* Frederick Accum, Philadelphia.
1818 *A Practical Treatise on Chemical Tests,* Frederick Accum, London.
1820 *A Treatise on Adulteration of Food and Culinary Poisons,* Frederick Accum, London.
1825 *The Elements of Medical Chemistry,* John Ayrton Paris, London.
1825 *Nouvelle Nomenclature Chemique,* J. B. Caventou, Paris.
1859 *Familiar Letters on Chemistry,* Justus von Liebig, London.
1861 *Chemical History of a Candle,* Michael Faraday, New York.

MEDICINE, HISTORICAL AND SPECIAL

1533 *The Works of Hippocrates* (Greek), Basle.
1542 *De Re Medica,* Cornelius Celsus, Lyons.
1542 *De Medica Materia,* Pedanius Dioscorides, Basil.
1542 *De Re Medica,* Johannes Mesue (Jacob Silvius), Paris.
1547 *De Simplicium Medicamentorium,* Claudius Galenus, Lyons.
1552 *Labyrinthus Medicorum Errantum,* Paracelsus.

1583 *Archidoxorum,* Paracelsus, Basil.
1595 *Li Maravigliosi Secreti de Medicina e Chirurgia,* Zapata, Venice.
1627 *Aphorismes de Hippocrate,* Paris.
1643 *Medicina Pauperum,* Johann Prevost, Lyons.
1656 *The English Physician,* Enlarged, Nicholas Culpeper, London.
1657 *Medicorum Omnium Magni Hippocratis,* Geneva.
1661 *Galenus, Moralus ac Mysticus,* Louvain.
1661 *Theatrum Sympatheticum,* Digby, Papin, Von Helmont, etc., Amsterdam.
1683 *Mirothecium,* Joseph Francesco, Venice.
1744 *Inquiries Concerning the Virtues of Tar Water,* Dr. George Berkeley, London.
1911 *Old Time Makers of Medicine,* James J. Walsh, New York.
1917 *The Growth of Medicine,* Albert H. Buck, New Haven.
1922 *The Evolution of Modern Medicine,* Sir William Osler, New Haven.
1922 *The History of Medicine,* Fielding H. Garrison, Philadelphia.
1922 *The History of Medicine,* Walter Libby, Boston.
1923 *Cures,* James J. Walsh, New York.
1923 *The Medicine Man,* John Lee Maddox, New York.
1923 *History of Magic and Experimental Science,* Lynn Thorndike, New York.
1925 *Medicine, An Historical Outline,* Major G. Seelig, Baltimore.
1926 *Early Medical and Biological Science,* R. T. Gunther, Oxford.
1926 *Arabian Medicine* (2 vols.), Donald Campbell, London.

Fig. 61.—Photograph of pharmacy exhibit at the Sesqui-centennial Exposition, Philadelphia, 1926. See page 539.

1926 *The Healing Gods of Ancient Civilizations,* Walter Addison Jayne, New Haven.

GENERAL SCIENCE

1520 *Naturæ Historiarum,* C. Plinius, Secundus.
1898 *A History of the Warfare of Science and Theology,* Andrew D. White, New York.
1899 *Religion and Science,* John W. Draper, New York.
1904 *The Follies of Science,* H. Carrington Bolton, Milwaukee.
1905 *Pioneers of Science,* Sir Oliver Lodge, London.
1905 *Little Journeys to the Homes of Great Scientists,* Elbert Hubbard, East Aurora.
1917 *An Introduction to the History of Science,* Walter Libby, Boston.
1925 *Beacon Lights of Science,* Theodore F. van Wagenen, New York.

MISCELLANEOUS

1659 *A True and Faithful Relation of What Passed for Many Years Between John Dee and Some Spirits,* London.
1720 *Herbal,* William Salmon, London.
1748 *A Complete History of Drugs,* Pierre Pomet, London.
1759 *Dictionaire Universel des Drouges Simple,* Nicholas Lemery, Paris.
1874 *Pharmacographia, A History of Drugs,* Flückiger and Hanbury, London.
1887 *The Real History of the Rosicrucians,* A. E. Waite, London.
1887 The *Rosicrucians, Their Rites and Mysteries,* Hargrave Jennings, London.
1913 *Giordano Bruno,* C. Turnbull, San Diego.

1913 *The Lost Language of Symbolism,* Harold Bayley, Philadelphia.

1920 *Handbuch der Pharmakognosie,* W. O. A. Tschirsch, Leipzig.

1922 *The Old English Herbals,* Eleanour Sinclair Rohde, London.

1923 *Béchamp and Pasteur,* E. Douglass Hume, Chicago.

1924 *Poison Mysteries in History, Romance and Crime,* C. J. S. Thompson, Phila.

1924 *The Golden Bough,* Sir James G. Frazer, New York.

1926 *The Microbe Hunters,* Paul de Kruif, New York.

CHRONOLOGICAL TABLE

This table is intended to serve as a convenient survey of events of importance in pharmacy. The chief events in general history, as well as in other sciences than pharmacy, are frequently included. The dates are not intended to be exact in every case. Many of them refer to periods or are approximations.

B.C.	
7000 to 2000	Neolithic Age in Europe.
5000 to 4500	Dawn of Sumerian, Egyptian, and Babylonian civilizations.
3700	Date of the earliest prescription in the British Medical Museum.
2900 to 2600	Age of the Pyramid Builders.
2250	Dynasty XII of the Egyptians; date of the Prisse Papyrus, the oldest human document in existence, in which the author complains of the degeneracy of his own age and longs for the "good old times" of his forefathers.
	Code of Hammurabi, a medical code of the Babylonians.
2000	Kahun Papyrus, which deals with veterinary medicine.
1600	Edwin Smith Papyrus, dealing with surgery and internal medicine.
	Hearst Papyrus, identical in part with the Ebers Papyrus.

	Lesser Berlin Papyrus, dealing with magic and surgery.
1552	Ebers Papyrus, dealing mainly with pharmacy. Moses was a young man at this time.
1350	Berlin Papyrus, a duplication of parts of the Ebers Papyrus.
1000	London Medical Papyrus, concerned with medicine and magic.
2000 to 1000	Bronze Age in Europe.
	Pun Tsao or Great Herbal of Chinese.
1000	Building of Temple at Jerusalem by King Solomon.
990	Age of Homeric Legends.
650	Library at Sardanapalus.
600	Second Babylonian Empire.
	Earliest period of the gods and goddesses of Greek mythology, including Aesculapius, the Father of Medicine, and Chiron, "Sire of Pharmacy."
590	Thales, the Greek astronomer and mathematician.
	Solon, the first Greek politician.
560	Birth of Buddha.
550	Pythagoras, a Greek philosopher who was a practicing physician.
	Xenophanes, who believed that the earth had at one time been covered by the sea.
	Empedocles, the earliest comparative anatomist and the originator of the idea of the four elements—earth, air, fire, and water.
	Alcmæon, the first recorded dissector of animals.

515	Confucius, the Chinese philosopher.
500	Aesclepiades and temples of Aesculapius.
	Anaxagoras, the father of meteorology and the first to explain the phases of the moon.
478	Herodotus, the greatest of Greek historians.
460	Hippocrates, the real father of medicine, who as a dispenser of his own remedies, was an early pharmacist.
420	Democritus, author of a theory of matter in which the word "atom" is first used.
	Leucippus, co-worker and pupil of Democritus.
400	Socrates, the famous philosopher who died by the hemlock cup.
390	Plato, the greatest speculative philosopher of the Greeks.
370	Diogenes, the greatest cynic of all time.
360	Aristotle, the first natural scientist; for a time a "seller of drugs"; teacher of Alexander.
340	Alexander, world conqueror; founder of Alexandria.
300	Theophrastus, the Father of Botany.
	Euclid, the Greek geometer, whose textbook remained unchanged for nearly 2000 years.
240	Archimedes, the greatest mathematician and engineer of the Greeks; discoverer of specific gravity.
	Aristarchus, who had ideas regarding the mechanics of the solar system many centuries in advance of his time.

Eratosthenes, an Alexandrian Greek who measured the circumference of the earth centuries in advance of its circumnavigation.

210 Building of the Great Chinese Wall begun.

160 Hipparchus, who measured the length of the year within twelve seconds of the truth.

Herophilus and Erasistratus, first recorded dissectors of the human body.

Serapion of Alexandria, who introduced many nauseous animal drugs into Roman medical practice.

Archagathus, an early Roman surgeon and dispenser of medicines.

150 Sundial superseded by clepsydra at Rome.

Paper first made in China.

Hero and Ctesibus, who invented the first slot machine and other mechanical marvels of the time.

Menecrates originates diachylon plaster.

Nicander originates theriacs.

80 Mithridates, the first student of toxicology, for whom the most famous theriac of later times was named.

Damocrates, physician to Nero, who invented a famous theriac.

60 Lucretius, who elaborated the atomic theory of Democritus.

Cicero, the greatest Roman statesman.

Julius Cæsar, Emperor of Rome, corrects the calendar.

Augustus Cæsar, Emperor of Rome, again corrects the calendar.

50 Vitruvius, famous Roman Engineer, the first to describe lead poisoning.

A.D.

25 Celsus, famous Roman physician.

Strabo, noted Roman geographer, who suffered from "strabismus."

Tiberius, Emperor of Rome.

Scribonius Largus, physician to Tiberius and compiler of a pharmaceutical formulary.

Horace, Virgil, and Livy, celebrated contributors to Roman literature during its Golden Age.

50 Pliny, writer of most noted ancient work on natural history.

Nero, Rome's most tyrannical and cruel Emperor.

Locusta, an early poisoner.

Agrippina, accomplice of Locusta.

60 Dioscorides, earliest authority on materia medica.

70 Destruction of Jerusalem by Titus.

80 Roman Coliseum completed.

100 Rufus of Ephesus, writer on medical subjects.

Trajan, Roman Emperor.

Tacitus, Roman historian.

Juvenal, Roman writer.

	Plutarch, Roman biographer, the most famous of olden times.
	Roman jurisprudence flourishes.
125	Hadrian, Roman Emperor, originator of a theriac.
132	Claudius Ptolemaius, Alexandrian astronomer.
150	Galen, Rome's most celebrated pharmacist and physician.
	Terra Sigillata extensively used in medicine. (The earliest form of trademarked article.)
	Theriacs highly esteemed as antidotes.
170	Marcus Aurelius, Roman Emperor and Stoic philosopher.
	Lærtus, a Greek historian.
300	Cosmas and Damian, semi-mythical characters venerated in Europe as patron saints of pharmacy.
	Diocletian, persecutor of early Christians, builds baths containing 3000 white marble benches.
330	Constantinople becomes capital of Roman Empire under Constantine.
400	Oribasius, Greek physician to Emperor Julian.
415	Death of Hypatia.
435	Nestorius, Bishop of Constantinople, banished by Church and takes followers to Persia.
476	Completion of conquest of Rome by Germanic tribes.
	Clovis develops the Salic law of the Franks.

FIG. 62. PHOTOGRAPH OF SECTION OF PHARMACY EXHIBIT AT SESQUI-CENTENNIAL EXPOSITION, PHILADELPHIA, 1926, SHOWING AN ANCIENT PHARMACY. SEE PAGE 539.

480	Aetius, Roman authority on plasters.
500	Merlin, the necromancer of the Arthurian legends.
	Theodoric the Ostrogoth, passed severe laws affecting medical practice.
529	Founding of Benedictine monastery at Mount Cassino.
537	Church of St. Sophia dedicated at Constantinople.
550	Alexander of Tralles, who used rhubarb, cantharides, and colchicum in medicine.
	Introduction of the game of chess from India.
571	Birth of Mohammed.
580	Latin ceases to be spoken in Italy.
600	Aaron's *Pandects,* a famous medical work quoted in later centuries.
	Ethelbert of England draws up first code of laws.
622	Hegira of Mohammed.
640	Destruction of Alexandrian library by Omar.
644	Assassination of Omar and division of the Caliphate.
650	Paul of Aegina, one of the first medical authorities to publish a "quid pro quo."
	Aaron the Presbyter and John the Grammarian; translators of Greek and Roman works into Arabic.
712	Art of paper making brought by the Arabs from Samarkand.
750	Geber, the Father of Alchemy.
772	Bakischwah, a celebrated Christian pharmacist and physician.

800 Haroun al Raschid, made famous by *Arabian Nights.*

Charlemagne, founder of the Holy Roman Empire.

Johannitus, translator of Galen's works into Arabic.

830 Mesue Senior, physician to many successful Caliphs and author of a pharmaceutical formulary, also known as Janus Damascenus.

Jesu Haly, a pupil of Janus Damascenus.

Alkindi, one of the few Arabian authorities who was really a Moslem.

St. Mark's Church in Venice founded.

850 School of Salerno first mentioned.

875 Rhazes, head of hospital at Bagdad and author of works on pharmacy.

Alfred the Great of England, a poor cake baker but a good King.

Helias, Patriarch of Jerusalem, who sent theriac to Alfred.

950 Albucasis, author of a noted pharmaceutical and medical work.

Herbarium Apuleui Platonici (the earliest manuscript herbal).

Hortulus, another herbal.

950 *Leech Book of Bald,* a Saxon recipe book.

Lacnunga, another Saxon recipe book, written in the style of *vers libre.*

Pope Sylvester II, the most tolerant and highly educated of Popes; introduced decimal notation into Europe.

1000	Mesue Junior, author of an apothecaries' manual quoted for 500 years.
	Avicenna, eminent philosopher, physician, and pharmacist.
1042	Institution of "Royal Touch" in England, for the cure of King's evil.
1050	Constantinus Africanus, great translator of his time.
	Johannes Afflatus, pupil of Constantinus, author of an encyclopedia of drugs and medicines.
	Serapion Junior, noted pharmaceutical authority.
	Guefit, pharmaceutical writer.
	Baytar, pharmaceutical writer.
	Founding of Schools of Toledo, Seville, and Cordova.
	Donnolo's *Antidotary*, written by an Italian Jew of Cordova.
1055	Revival of arts in Europe.
1070	Beginning of Westminster Abbey and London Bridge.
1076	Salerno the leading university of Europe with more than ten thousand students.
1095	Beginning of the Crusades.
1100	Dialect of the Isle de France becomes the pervading language of France.
1110	University of Paris founded.
1113	University of Bologna founded.
1118	Order of Knights Templar instituted.
1131	Council of Rheims forbids clerics to practice medicine.

1137	St. Bartholomew's Hospital founded in London.
	Abbess Hildegarde.
1140	Avenzoar, Spanish physician who dared oppose the teaching of Galen.
	Antidotary of Nicholas of Salerno.
	Edict of Roger of Sicily affecting pharmacy.
	Averrhoes, Spanish authority on pharmacy, author of the *Colliget*.
	Trotula, famous woman physician.
1160	Maimonides, celebrated physician—the most famous Jew since the time of Moses.
	Richard the Lion Hearted, who tried to induce Maimonides to go to England.
	Hospitals of great completeness and efficiency instituted by Arabians.
	Sugar and spices brought to Europe by Venetians.
1163	Edict of Tours, restricting surgery to barbers and mountebanks.
1167	University of Oxford founded.
1178	Apothecaries first mentioned in French records.
1180	Guild of Pepperers in London, which included dealers in drugs.
1187	Jerusalem conquered by the Mohammedans.
1200	Period of the Troubadours in France and the Minnesingers in Germany.
1209	Cambridge University founded.
1215	Magna Charta granted to barons at Runnymede by King John.

1222 University of Padua founded.

1224 Frederick of Sicily issues decree affecting medicine and pharmacy.

University of Naples founded.

1233 First known apothecary shop in Germany, in Wetzlar.

Vincent de Beauvais, author of a widely used work on pharmacy.

1250 Albertus Magnus, famous disciple of alchemy.

Thomas Aquinas, an Italian theologian, pupil of Albertus Magnus.

Roger Bacon, a scientist ten centuries ahead of his time; foretells submarines, airplanes, and automobiles.

Gilbertus Anglicanus, author of a pharmaceutical formulary.

Antidotary of Nicholas Myrepsus.

1258 Bagdad conquered by Persians.

1260 Arnold of Villanova, who introduced tinctures into pharmacy.

Raymond Lully, a believer in the virtues of *aqua ardens* and an alleged transmuter of gold.

Gerard of Cremona, a famous translator of medical and pharmaceutical works.

1261 Private wars of the Lords of France suppressed by the laws of St. Louis.

1267 Jews forbidden to practice medicine in parts of Europe.

1271 Herborists and apothecaries forbidden to practice medicine in Paris.

1275	Peter of Albano, author of a widely used work on pharmacy.
	Peter of Spain, author of a celebrated pharmaceutical formulary.
	Marco Polo, the Venetian whose travels led to the downfall of the commercial supremacy of his country.
1297	Guild of Pharmacists organized in Bruges.
1300	Dante, a member of the Guild of Apothecaries, better known as a poet.
1302	The mariners' compass first utilized in Europe.
1314	*Formulary* of John Gaddesden.
1334	Giotto, Italian artist, flourishes.
1335	Spain wrests power from Moors in Cadiz, Cordova, and Seville.
	Alhambra built by Moors at Granada.
1345	First recorded apothecary shop in London.
	Guild of Grocers given permission to incorporate.
	Pension granted by Edward III to Coursus de Gangland, apothecary.
1346	Battle of Crecy; gunpowder first used in warfare.
1348	Great Plague in Europe—called the "Black Death."
1350	Apothecaries in France required to subscribe to a formal oath.
	French law prohibits any but apothecaries, students and mendicant monks from practicing medicine.
	Guy de Chauliac, a medical authority of note.

1356 Sir John Mandeville begins his travels.
1359 Ordinance passed in Paris concerning master apothecaries.
1360 Petrarch, Italian poet who wrote principally to Laura.
Boccaccio, the humorist whose stories are a bit *risqué*.
Chaucer, the English poet who encourages poor spellers.
1375 *Formulary* of John Mirfield.
Nicholas Flamel, the philanthropic alchemist.
1380 Wycliffe translates the New Testament into English.
1400 Basil Valentine, the discoverer of antimony.
1412 Jews expelled from Spain.
Isaac Hollandus and his son, noted as alchemists.
1420 Portuguese exploration encouraged by Henry the Navigator.
1429 Charter granted to Guild of Grocers in England (including apothecaries).
Decrees of Henry VI commanding transmutation experiments.
1430 Order of Golden Fleece founded.
1440 Invention of printing.
1441 Canon Ripley, English alchemist, who wrote his work in verse.
1450 Fall of Constantinople and end of Byzantine Empire.
Guild of Grocers given charge of weighing all imported merchandise.
Bernard Trevisan, who wasted his life in the search for the philosopher's stone.

1460	Wood engraving invented for book illustrations.
1470	*Ars Memorativa,* by Anton Sorg, containing the earliest picture of an apothecary shop.
1475	Leonardo da Vinci, the artist who studied anatomy.
	Guild of Grocers given exclusive power of garbling drugs and spices and examining the wares of the apothecary.
1477	Caxton establishes printing in England.
1480	First poison law passed by James I of Scotland.
1486	*Ortus Sanitatus,* containing picture of early apothecary shop.
	Brunschwyk's work, containing picture of early apothecary shop.
1488	Bartholomew Dias, a Portuguese navigator rounds the Cape of Good Hope.
1492	Columbus discovers America.
1493	Senate of Nuremburg passes laws suppressing alchemy.
	Laws forbidding transmutation passed in England.
1497	Venice the centre of the European trade with the Orient.
	John and Sebastian Cabot explore America.
1498	Vasco da Gama first reaches India by an all-sea route.
	Lisbon the centre of the world's trade. Venice declines in importance.
1499	Amerigo Vespucius reaches America, the luckiest of the lot, for his name is perpetuated.

1500	Copernicus, Polish astronomer, who set the world straight in its cosmogony.
1502	Raphael, Michael Angelo, Titian, and Correggio, flourish—a great period for the "old masters."
1506	St. Peter's in Rome begun.
1517	Luther, Melancthon, and Erasmus are busy with the Reformation.
1522	Magellan circumnavigates the globe.
1525	Paracelsus, the world's greatest chemical, medical, and pharmaceutical iconoclast.
	Bancke's Herbal published.
1526	*Treveris' Herbal* published.
	Tyndale translates the New Testament into English.
1529	Senate of Nuremburg authorizes apothecaries to follow formulas in *Luminare Majus.*
	Albrecht Dürer and Holbein of the German school of painters flourish.
1530	*Brunfels' Herbal* published.
1531	England passes law making murder by poison high treason.
	Spinning wheel invented in Germany.
1533	Padua botanical garden founded.
1534	Order of the Jesuits founded by Loyola.
1536	Brunfels writes *Reformation of Pharmacy.*
	Henry VIII becomes a royal dabbler in pharmacy.
	John Knox, the Scottish reformer, flourishes; also Calvin.
1540	Vesalius, the greatest anatomist up to his time.

	English barber-surgeons chartered.
1542	Pharmacists given greater privileges under English laws.
1544	Florence botanical garden founded.
1546	Valerius Cordus *Dispensatory* printed by order of the Senate of Nuremberg.
1547	Bologna botanical garden founded.
	Palestrina founds Italian church music.
1548	Charles V of Germany issues decree regulating pharmacy.
1550	Bulleyn's rules for apothecaries issued.
	Carey's Herbal published.
1551	*Turner's Herbal* published.
1557	Poison laws of England strengthened.
1559	Pharmacopœia of Mantua issued.
1560	Tobacco introduced into Europe by Nicot.
1561	*Pharmacopœia of Basle* issued.
1562	Witchcraft made a capital offense in England.
1564	*Pharmacopœia of Augsburg* issued.
1565	Protest of Nuremburg pharmacists against unjust treatment.
	Pharmacopœia of Cologne issued.
1568	Hans Sach's *True Description of All Professions* published.
1570	Paris botanical garden founded.
1575	Elizabeth of England takes lessons in alchemy from John Dee and becomes an experimenter with pharmaceutical preparations like her royal father.
	John Dee and Edward Kelly.
1577 to 1580	Drake circumnavigates the globe.

	Tycho Brahe and Kepler make astronomical discoveries.
1580	Alchemistic frenzy at Prague, under Rudolph.
1582	Pope Gregory reforms the calendar.
1585	Controversy over theriac in London.
	Physicians in Paris compel apothecaries to take a humiliating oath of subservience.
1588	Spanish Armada destroyed.
1589	Galileo demonstrates law of falling bodies at Pisa.
1595	Libavius, famous chemical author.
	Quercetanus, two noted pharmaceutical authors use this name during this century.
1597	*Gerarde's Herbal* published.
1598	Montpellier botanical garden founded.
	Francis Bacon, said to have been the wisest man of his century.
1600	The Fuggers, celebrated commercial and financial group which dominated European trade.
	Raymond Minderer, originator of a remedy still prescribed under his name by physicians who employ it.
	Giordano Bruno burned at the stake.
	William Shakespeare, literary and dramatic genius of the ages.
	Ben Jonson, noted English poet.
1602	G. Ryff publishes a *Book of Confections.*
	Paris apothecaries given monopoly of the sale of gingerbread.
	Mayerne expelled from France for prescribing calomel and other mercurials.

	Compound infusion of senna originated.
1605	Cervantes writes *Don Quixote.*
1607	Jamestown, Virginia, settled.
1608	*Wecker's Antidotary* published.
1609	Oswald Crollius publishes *Basilica Chemica,* containing the earliest recorded method of making calomel.
1610	Potassium acetate first made; called "Terra Folia Tartrata."
	First French pharmacists reach Canada.
	Telescope invented in Holland.
1617	Guild of Apothecaries in London chartered.
1618	First *London Pharmacopœia* published.
1619	*Antidotary of Quercetanus* published.
	Milk sugar discovered by Bartolette.
	Negro slavery introduced into America.
1620	Pilgrim Fathers land at Plymouth Rock, Massachusetts.
	Giles Firmin, early American apothecary.
	Dr. Samuel Fuller, early American physician.
	Francis Bacon publishes his *Novum Organum.*
1621	Raymond Minderer publishes *Military Pharmacy and Medicine.*
	Van Helmont, originator of the word "gas," discoverer of carbon dioxide.
1622	First newspaper published in England.
1624	Grocers protest to James I concerning withdrawal of apothecaries from Guild; overruled.
	Antidotarium Romanum of Frankfort issued.

FIG. 63.—PHOTOGRAPH OF SECTION OF PHARMACY EXHIBIT AT SESQUI-CENTENNIAL EXPOSITION, PHILADELPHIA, 1926, SHOWING A MODERN PHARMACY. SEE PAGE 539.

	Goddard's Drops patented; made from human bones; the first patent medicine.
1627	*Augsburg Pharmacopœia* revised.
	Cologne Pharmacopœia revised.
1628	Harvey publishes book on *Circulation of the Blood.*
1629	French apothecaries awarded a heraldic banner.
1631	Adrian Mynsicht, chemical and pharmaceutical authority; originator of aromatic sulphuric acid.
1632	Apothecaries' Society of London acquires hall.
1633	Galileo appears before Inquisition.
1635	*Jardin des Plantes* established by Louis XIII.
1636	Harvard College founded.
	Virginia Assembly regulates fees of pharmacists and physicians.
	Amsterdam Pharmacopœia issued.
	Van Dyke and Rembrandt join the "old masters."
1639	*Codex* of Paris issued.
	Brussels Pharmacopœia issued.
	Antidotary of Bologna published.
	Pharmaceutical and Medical Chemistry by Schroeder published.
1642	Torricelli invents barometer.
	Milton, the blind poet of England.
1645	Boyle founds *Invisible Society.*
	Glauber publishes *Pharmacopœia Spagirica.*
1646	First pharmacy recorded in Boston.
1650	*London Pharmacopœia* revised.

	Toffana, the most noted poisoner of the century.
	Sir Kenelm Digby and sympathetic remedies.
1652	Surgeons of New York ask privilege of shaving officers of visiting vessels.
1653	Isaac Walton publishes his *Compleat Angler,* and makes fish stories popular.
1654	Von Guericke invents air pump.
1656	Culpeper's *English Physician* published.
1658	*Denmark Pharmacopœia* issued.
1659	*London Pharmacopœia* revised.
1660	Quercetanus (N. Chesneau) *Pharmacie Theorique.*
	Golden Age of French literature.
1661	Robert Boyle, great scientist with a weakness for pharmacy.
	Isaac Newton, started as a pharmacist's assistant, finished as one of the world's greatest thinkers.
	Leibnitz, great German philosopher and mathematician.
	René Descartes.
1662	Royal Society incorporated in London.
1664	New Jersey passes earliest law regulating apothecaries in the new world.
	Velasquez and Murillo represent the Spanish school of painters.
1665	Great Plague in London.
1666	Last edition of *Dispensatory* of Valerius Cordus.
	Academy of Sciences of Paris founded.
1667	Robert Hooke first describes plant cells.
1669	Sydenham publishes formula for laudanum.

	Journeymen apothecaries in Germany required to take formal oath.
	Moscherosch satirizes pharmacy in Germany.
1670	Christopher Glaser, celebrated French pharmacist.
	Brinvillier's Case, world's greatest poisoning case.
	Salmon's *English Physician* published.
1672	Seignette first prepares Rochelle Salt.
1673	Leeuwenhoek, the Dutch janitor who was the first microscopist of note.
1674	Chelsea botanical garden founded.
1675	Hoffmann publishes *Clavis Pharmaceutica,* a great German work on pharmacy.
	Christopher Wren begins St. Paul's Cathedral.
	Charas publishes *Pharmacopœia Royale et Galenique,* a great French work on pharmacy.
1677	Donizelli publishes *Teatro Farmaceutico,* a great Italian work on pharmacy.
	Swiss Pharmacopœia issued.
1678	*London Pharmacopœia* revised.
	John Bunyan writes *Pilgrim's Progress.*
1680	Denis Papin builds steam engine which later gives Watt his great idea.
1682	William Penn founds Philadelphia.
1683	Controversy between physicians and pharmacists at Bruges; physicians are prohibited from dispensing.
1687	Newton's *Principia* published.
	Schroedero-Hoffmann Pharmacopœia.
1691	Pomet publishes his *History of Drugs.*

	Witchcraft furore in New England.
1697	Lemery publishes his *Universal Pharmacopœia* and his *Dictionary of Drugs.*
1699	Book by unknown author, entitled *All Professions and Trades;* satirizes pharmacy.
1700	Becher and Stahl formulate phlogiston theory.
1701	Yale University founded.
1703	English House of Lords authorizes prescribing by apothecaries.
	Pharmacists charge exorbitant prices for medicine in Great Britain.
1705	*Swiss Pharmacopœia* revised.
1707	Isaac Watts writes many hymns.
1711	First patent medicine in America—a consumption cure called " Tuscorora Rice."
1712	Barchusen's *Synopsis of Pharmacy* published.
	Compound tincture of gentian first appears, as a patent medicine under the name of "Stoughton's Elixir."
	Dean Swift, England's greatest satirist, writes.
1714	Fahrenheit devises thermometric scale.
	Hans Sloane, one of England's greatest scientists and philanthropists.
1715	Bartram's botanical garden established in Philadelphia.
1717	England's great literary awakening—Steele, Addison, Pope, and DeFoe.
1718	Lady Mary Wortley Montagu has son inoculated for smallpox.
	Hoffmann's Anodyne introduced.

	Sale of poppy seeds prohibited in France.
	London Pharmacopœia revised; contains formula for Paregoric, and Compound Tincture of Lavender for first time.
1719	DeFoe publishes *Robinson Crusoe.*
1720	Godfrey's Cordial popular as a household remedy in Great Britain.
	Salmon's Herbal published.
	The two famous Geoffroys of Paris, the greatest pharmacists of their day.
	Boulduc, another great French pharmacist.
1722	*Edinburgh Pharmacopœia* first appeared.
1726	Bateman's Drops patented.
1730	Reaumur devises thermometric scale.
	Apothecaries of Nuremberg forbidden to give New Year's gifts to physicians.
1732	George Washington born.
1735	French decree against sale of poppy seeds made more drastic.
1740	University of Pennsylvania founded.
	Linnæus publishes his most famous work on botany.
	Dover's Powder introduced.
1741	*Formulary* of St. Bartholomew, St. Thomas's and Gray's Hospitals issued.
1742	Celsius devises new thermometer scale.
1743	American Philosophical Society founded.
	Hooper's Pills patented.
1745	Barbers separated from surgeons in England.
1746	Compound tincture of benzoin first recognized by the *London Pharmacopœia,* revised in this year.

	Princeton University founded.
1747	Marggraf discovers beet sugar.
1750	Buffon, France's greatest naturalist.
	Zittmann's Decoction introduced.
1751	First medical society in Boston.
1752	London Medical Society founded.
	First dispensary in America opened, in Pennsylvania Hospital, Philadelphia, Jonathan Roberts the first apothecary.
1760	First act to regulate the practice of medicine passed in New York.
	Weigleb, a famous German pharmacist, aids the phlogistonists.
1762	Antoine Baumé, France's most famous pharmacist of the eighteenth century, and originator of the hydrometer bearing his name, publishes his *Elements of Pharmacy.*
	P. J. Macquer, French pharmacist who became famous as the author of an encyclopedia of chemistry.
1765	First Medical School in the United States opened at the University of Pennsylvania.
	John Morgan teaches pharmacy in University of Pennsylvania and introduces prescription writing into the United States.
1766	Parmentier, French pharmacist who introduced the cultivation of the potato into France.
	Rouelle, French pharmacist who gave lectures on chemistry in his pharmacy. Lavoisier is said to have attended these lectures.

	Linnæus knew and named thousands of plants.
1770	Oxygen discovered by Priestley and Scheele; the latter was a Swedish apothecary who worked in a laboratory attached to his store and who became the greatest pharmacist of the century.
1771	First edition of *Encyclopedia Britannica.*
	Swiss Pharmacopœia revised.
	Danish Pharmacopœia issued.
1772	Nitrogen discovered by Rutherford.
	New Jersey passes an act regulating the practice of medicine.
	Scheele begins a series of brilliant discoveries in chemistry.
1773	Repeal of French law prohibiting sale of poppy seeds.
1775	Place of oxygen in chemistry defined by Lavoisier.
	Beginning of overthrow of phlogiston theory.
	John Morgan Surgeon-General of the Medical Department of the United States Army.
	Office of Apothecary-General created in United States Army.
	Louis XVI purchases tapeworm cure of Madame Nouffler.
1776	Declaration of American Independence.
	Christopher Marshall, famous American pharmacist appointed by government to look after needs of wounded soldiers in Philadelphia.

1778	Count Rumford shows heat to be a form of energy—a final blow to the phlogiston theory.
	Military Pharmacopœia issued in Philadelphia.
	Russian Pharmacopœia issued.
1780	Benjamin Franklin invents bifocal lenses.
1781	Cavendish synthesizes water.
1783	Barbers and surgeons separated in Austria.
1784	Cavendish discovers hydrogen.
	First daily newspaper published in United States—the *Pennsylvania Packet* or *Daily Advertiser*.
1785	Lavoisier analyzes water.
	Fowler's Solution introduced.
	Infusion of digitalis introduced by Withering (Withering's Solution).
	Berthollett, famous French chemist.
	Fourcroy, another famous French chemist.
	Black, famous English chemist.
	Cagliostro, master charlatan of the century.
1787	*Materia Medica Americana* published by Doctor Schoepf.
	Formula for Huxham's Tincture published.
1788	*London Pharmacopœia* revised; castor oil first given official recognition.
1789	Beginning of French Revolution.
	Gluck, Hayden, Mozart, and Beethoven flourish.
1790	First medical journal, published in New York.
	Trommsdorff founds Pharmaceutical Institute in Germany.

Fig. 64.—Photograph of a section of pharmacy exhibit at Sesqui-centennial Exposition, Philadelphia, 1926, showing progress of pharmaceutical education. See page 539.

	Carbonated water first made and sold, in Geneva.
1791	LeBlanc's soda process perfected.
	Galvani, whose name is perpetuated in the terminology of electrical science.
1794	Lavoisier beheaded.
1796	Jenner vaccinates first patient.
1799	Compound Licorice Powder introduced.
	Royal Institution founded, in London, by Benjamin Thompson, an American.
1800	Sir Humphrey Davy discovers anæsthetic effects of nitrous oxide.
	Lamarck, the great French naturalist.
	Cuvier, the first French zoölogist.
	Volta, who made electro-chemistry possible.
1801	Hare invents oxyhydrogen blowpipe.
1803	Pharmaceutical Society founded in Paris.
1804	Dalton publishes atomic theory.
	First locomotive in Wales.
	First lead chamber plant for manufacturing sulphuric acid, in United States.
	Sertürner, German apothecary, first prepares morphine; withholds final publication of his results until 1815.
1806	*Coxe's Dispensatory* issued.
1807	Fulton's steamboat makes first trip on Hudson River.
	Fitch's steamboat makes first trip on Delaware River.
1807	First code of medical ethics published in United States.

1808	*Pharmacopœia* of Massachusetts Medical Society issued.
	Dalton's theory amplified.
	Gay-Lussac's laws concerning gases published.
1809	French *Bulletin de Pharmacie,* first published; oldest pharmaceutical journal in the world, now published as *Journal de Pharmacie et de Chemie.*
1810	*Thatcher's Dispensatory* issued.
	Davy isolates alkali metals and alkali earth metals.
1811	Courtois, French pharmacist, discovers iodine.
	Columbian Chemical Society founded, the first society of its kind in America.
1812	Academy of Natural Sciences in Philadelphia founded, the first natural history society in the New World.
	Farr and Kunzi begin manufacture of pharmaceutical chemicals in Philadelphia, later developing into the firm of Powers & Weightman.
	War between Great Britain and America.
1813	Principle of percolation used by Dumont in decolorizing sugar syrup.
1814	Stephenson's first successful locomotive.
	Davy invents safety lamp.
	Faraday engaged by Davy at the Royal Society.
1815	Count Real first applies percolation to drugs.

1816 *Pharmacopœia* of New York Hospital issued.

1817 Pelletier, French pharmacist, discovers emetine.

1818 Thenard, French pharmacist, discovers hydrogen dioxide.

Pelletier and Caventou, French pharmacists, discover strychnine.

Codex Medicamentarius of France issued—the first national pharmacopœia having an unbroken history down to the present time.

1819 Pelletier and Caventou discover quinine.

1820 First *United States Pharmacopœia* issued.

Robiquet, French pharmacist, employs percolation in research upon bitter almond.

1821 Philadelphia College of Pharmacy founded.

Frederick Accum, popular writer on chemistry of his time.

James Cutbush, the last Apothecary-General of the United States Army.

John Ayrton Paris publishes *Pharmacologia.*

1822 Secret of Rosetta Stone deciphered.

1823 Chevreul publishes work on composition of fats and oils.

Massachusetts College of Pharmacy founded.

1824 Renssalaer Polytechnic Institute founded in Troy, N. Y.

Philadelphia College of Pharmacy publishes book exposing patent medicines.

Balard, French apothecary, discovers bromine.

1825	Franklin Institute founded in Philadelphia.
	The Boullays, French pharmacists, work on percolation.
	Faraday becomes Director of the Royal Institution, London.
	American Journal of Pharmacy founded. The oldest pharmaceutical journal in the English language.
1826	Henry Hennel, an English pharmacist synthesizes ethyl alcohol.
1828	Wöhler synthesizes urea from ammonium cyanate and breaks down distinction between organic and inorganic chemistry.
1829	New York College of Pharmacy founded.
	Daguerre introduces photography.
1830	New York College of Pharmacy exposes patent medicines.
1832	Morse invents the telegraph.
1840	Drug milling introduced by Hagner in Philadelphia.
1841	Maryland College of Pharmacy founded.
	George W. Andrews and Thomas Mackenzie hold first professorships in pharmacy, in America, in Baltimore.
	Pharmaceutical Society of Great Britain founded.
1842	Dr. Crawford W. Long first employs ether for general anæsthesia.
1846	William Procter, Jr., becomes first professor of pharmacy in Philadelphia.
	Sheffield Scientific School founded at Yale University.

1847	Lawrence School of Science founded at Harvard.
	Smithsonian Institution founded at Washington by Robert Smithson, an Englishman.
1848	First comprehensive code of pharmaceutical ethics, adopted by Philadelphia College of Pharmacy.
	Warburg's Tincture introduced as a nostrum.
1849	California gold rush.
1852	American Pharmaceutical Association founded.
	Code of pharmaceutical ethics adopted by A. Ph. A.
1856	W. H. Perkin accidentally discovers first coal tar color while trying to synthesize quinine.
	Béchamp, French pharmacist, studies yeast and isolates and names zymase.
1858	Submarine telegraph cable to Europe first used.
1859	Darwin publishes his *Origin of Species.*
	First Pennsylvania oil well flows.
1861	Massachusetts Institute of Technology founded.
	American Civil War begins.
1863	Pasteur and Béchamp investigate silkworm disease in France.
1864	School of Mines, Columbia University, founded.
1865	Mendel discovers laws affecting hybridization.
	Slavery abolished in United States with ending of Civil War.

1868	University of Michigan institutes Department of Pharmacy.
1871	Darwin publishes his *Descent of Man.*
1875	First meat inspection act, in Germany.
	First food adulteration act, in Great Britain.
1876	Centennial Exposition in Philadelphia.
	First Bell telephone.
1877	First phonograph.
1879	First food law, in Germany.
1883	Pasteur vaccinates against anthrax.
	University of Wisconsin institutes Department of Pharmacy.
1884	Knorr prepares antipyrin, one of the earliest coal tar synthetic remedies.
1888	*National Formulary* first issued by A. Ph. A.
1889	Behring discovers diphtheria antitoxin.
1893	John M. Maisch, great American pharmacist, receives Hanbury Medal.
1895	Marconi introduces wireless telegraphy.
	Roentgen announces discovery of X-rays.
1898	Radium discovered by the Curies, France.
	National Association of Retail Druggists founded in America.
1906	National Food and Drugs Act passed in United States.
1914	Harrison Anti-Narcotic Act passed in United States.
1915	Einstein promulgates relativity theory.
1919	Prohibition Amendment and national prohibition legislation passed in United States.

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